July 1982

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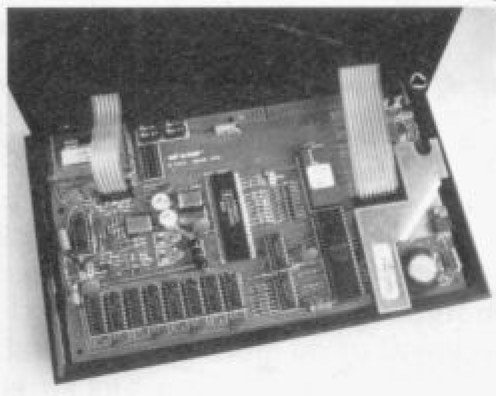
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NEXT MONTH

- **We assess Sinclair's new range of educational software**
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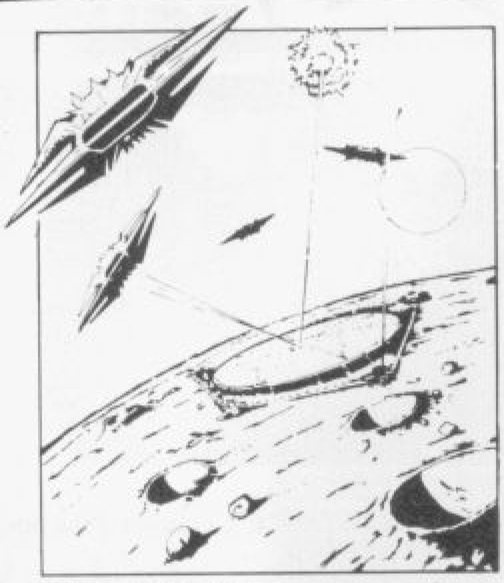
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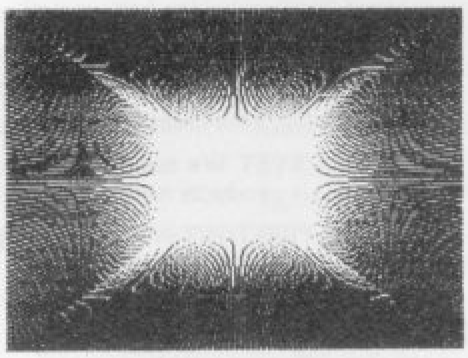
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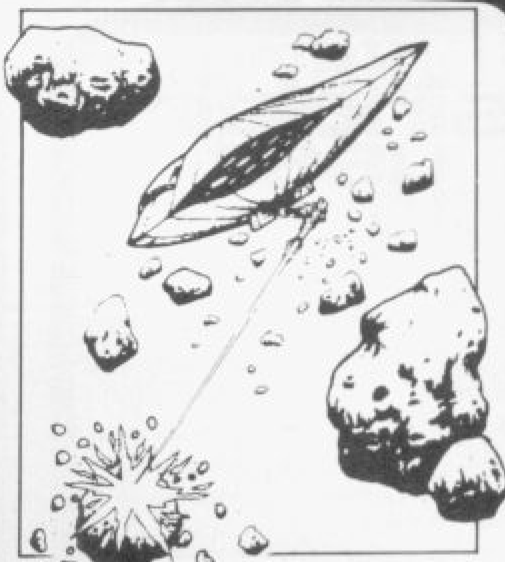
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Tempting gap in market

IF ANYONE questioned the size of the possible market for home computers, they should take note of the experience of W H Smith. The company sells more magazines on computers than it does women's magazines. There are three computer publications which sell more copies than the most popular women's magazine.

This explains why Smiths is expanding that side of its retailing steadily. As the company puts it, most of its sales are in "maturing markets", so the need to find new and dynamic lines is essential for its future.

The growth potential is phenomenal. It is estimated that, despite sales of almost 500,000 ZX-81s, Sinclair Research has tapped only about two percent of the estimated home computer market. Despite allowing for the fact that it is difficult to assess a market which did not exist two years ago, there is still an enormous hole in the market.

Smith's reaction in the medium term is to try to cover the whole market for both hardware and software. In the long term, it is thinking of specialising on one sector, probably software. That ensures that the route future development will follow is much the same as that for the music market — few people these days expect to be able to buy records in the same place as they buy their music systems.

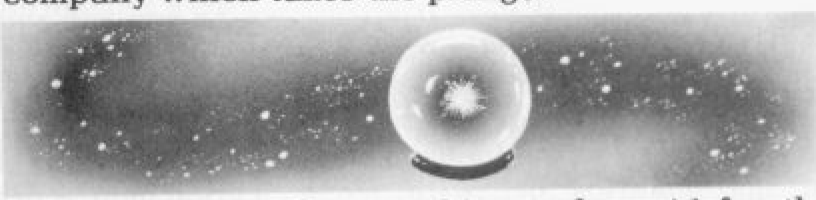
Follow the route a little further and you begin talking about computer systems designed for home use. One vision of the future, suggested by W H Smith, is that people start by buying some kind of simple keyboard which, in basic form, could be used as a typewriter or calculator. To this could be added various types of processor, memory and printer, to build a personal system to suit a variety of requirements.

Such thinking is perfectly logical and likely to happen, since it sounds very like the way in which Sony developed the music market. Before Sony split music centres into various parts, most people listened to their music on record players built as one unit. Such a thought prompts the question as to what the Japanese are doing about the home computer market.

It would be comforting to think that the lead which Sinclair Research and other British companies have in the field would be an advantage but such leads have been no insurance in the past and are unlikely to be in the future. That is especially true of the home computer market, where changes can happen so quickly.

The British companies involved are also small. One big push by a large Japanese conglomerate could be sufficient to push them on to the sidelines. If the market is as big as estimated, it would not even be necessary to launch a particularly innovative product model.

It would be pleasant to think it would be a British company which takes the plunge.



THERE IS possibly something to be said for the ponderous decision structures of many of Britain's major companies. With the limitation of personal initiative and the promotion of company spirit, the wish to leave and start a new business is severely curtailed.

Compare that to Clive Sinclair's companies, past and present, where initiative and freedom of thought have been encouraged. It is one of the benefits of being a small company that it is possible and it has been used, by Sinclair Research especially, to put new ideas into practice quickly.

The freedom, however, is not total. In the end it is Clive Sinclair who takes the important decisions. Having tasted some easing of constraints, it can be very frustrating when there is still some limitation to action.

It was that frustration which led to the departure of Richard Altwasser to join a growing band of former Sinclair colleagues from whom he now faces some form of competition.

The people behind Acorn Computers and the Grundy Newbrain, which finally was launched last month, all worked with Sinclair at some stage. Altwasser and his partner, Steven Vickers, are keeping quiet about their plans but it is unlikely they will be straying far from the microcomputer field they know so well.

Whether their new company will be big enough to consider launching a new computer is open to conjecture. Leaving that aside for the moment, there is still a large market in software and hardware peripherals where they could compete with their former employer.



Simplicity is best learning pattern

Dave Sayers relates how the ZX-81 has helped learning in his school.

THE POWER of a micro as a learning tool is often quoted in papers and magazines, yet most of the published programs are games and adventures — and good they are, too. Nonetheless, it is a pity that more educational games are not published; the little ZX-81 with even a basic 1K memory can be used to teach many of the fundamentals of mathematics or, with more memory, English.

The example programs included in this article, therefore, are all written within 1K. The reason is simple. To be good, a teaching game need not be complicated. Preferably it should teach only one thing, though that is not to say that mixtures of approaches are not desirable.

It should also, if possible, have a graphics display to help keep the attention of the child. Another good reason for keeping games simple is that many ZX owners, or owners of other machines, are young people like myself who have children at school. With the ZX available, it would be a waste if it were not used constructively to further a child's education.

Initially most people probably write programs of the 6 × 5 = ? variety. They are useful but not especially interesting. Try the program in figure one.

It is very simple; the program prints out 10 rows of graphics squares, with the number of squares printed at the end. It can be used to help to teach children who can count who have difficulty in associating those numbers with the written number — for instance, seven.

As you can see, I am starting at the very first basis of counting. My daughter has started learning to write, or record, numbers greater than 10, and this kind of game can be a great help. A program I have used flashes rows of squares for her to input the number — figure two. It was written specifically to help her understand the way in which numbers above 10 are recorded. The same program, of course, can be adapted easily to give help with numbers above 20.

Although the programs may appear limited, they are still giving valuable practice in learning skills which, if not understood fully, can lead later to difficulty in comprehending, for instance, the value attached to a carried 1 — in 9 + 9 we "carry one" which is really 10. You may say that is well known but rest assured there are plenty of children who find the true value of a carried figure a total mystery.

> 'The little ZX-81 with even a basic 1K memory can be used to teach the fundamentals of mathematics mathematics'

Computer-aided learning can give those children valuable lessons, for they will know immediately if they are correct or incorrect. In classes where books are marked once a lesson, the incorrectness of what they have done may become apparent only at the end of the lesson — or next day.

Once we have the child understanding counting to a certain total, speed practice becomes important in helping the child to rely less on physical cues of number and begins to depend on their internal memory of where they are in the count. The games should show varying numbers of shapes quickly on the screen, for which a running total has to be kept by the child, to be entered at the end of the run.

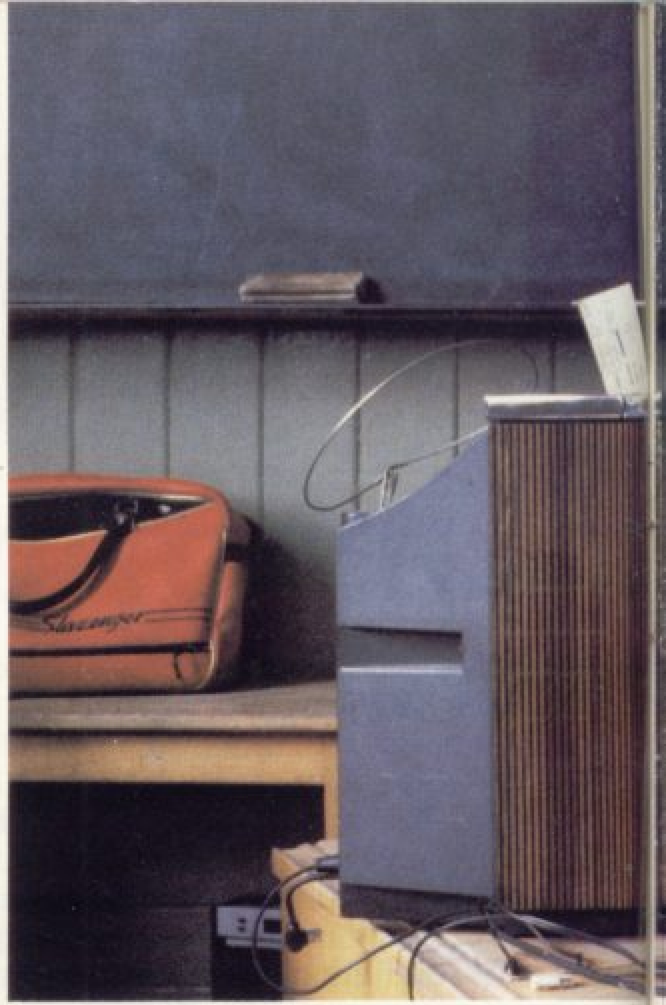
HISSING SID is an example of such a program. Snakes appear on the screen, varying numbers each time. A total is input at the end, which is checked — figure three.

There is plenty of fun while learning to count with this program, especially if it is altered to print the total at the end, after a short pause, to give children a chance to shout the answers. They love to see who can be first with the correct answer. Figure four shows how to do this.

This program can be altered in both speed of display and numbers of snakes. For larger numbers alter line 20 and for less time between displays alter line 100. If you make it long enough and quick enough it becomes fairly testing, even for adults.

I wrote a similar program on the Pet at school and tried it on my own class, as well as the class of a colleague.

My class, by now fairly blase where micros are concerned — some of them prefer me to use the ZX their fathers or brothers own one and they can crib my programs — enjoyed it a great deal. The colleague, who was interested in





what the computer could do, was surprised by the way in which some of the less-motivated children were captivated by the game. She was particularly impressed with the way in which one boy, who was finding addition a trial, began to store the numbers in his head; then, staring into space for a minute or so, as he totalled them, he finally delivered his answer in a very positive way.

Gone were the uncertainties he had about written sums, when he would often be at the teacher's desk complaining that he could not understand. Replacing it was the desire to beat the computer, to have his answer before it flashed on the screen.

BRIDGES is a game in which the children attempt to build a bridge by answering addition questions correctly. Each correct answer puts another span on the bridge. As before, they are adding blocks, rather than numbers — figure five.

When the game is run, blocks, in two rows, appear on the screen. If they are added correctly, a span is added to the bridge. If they are not added correctly, there is no penalty; the problem resumes again and again until it is solved correctly.

That is important, as there is no worry that the child will feel he or she has failed on the first few attempts if the bridge is not nearing completion.

Those with 16 or more K of memory might like to improve this program. For instance, the bridge may fill the whole screen and every time there is an incorrect answer a man might walk along the bridge and fall off, to land in a boat, from where he is returned to the bridge to climb and try again. Whether you use these ideas or not, it is important to pay careful attention to what you want your program to teach and never to take for granted the idea that children understand the logic of mathematics.

Figure 1.

```
10 FOR I=1 TO 10
20 FOR J=1 TO I
30 PRINT "▒ ";
40 NEXT J
50 PRINT I
60 PRINT
70 NEXT I
```

Figure 2.

```
10 LET A=(INT (RND*10)+10)
20 CLS
30 FOR I=1 TO A
40 PRINT "■ ";
50 NEXT I
55 PRINT
60 INPUT B
70 IF A=B THEN GOTO 10
80 PRINT "WRONG , IT WAS ";A
90 FOR I=1 TO 100
100 NEXT I
110 CLS
120 GOTO 10
```

Figure 3.

```
5 CLS
10 LET C=0
20 LET A=(INT (RND*5)+1)
30 FOR I=1 TO A
40 LET B=(INT (RND*6)+1)
50 LET C=C+B
60 FOR J=1 TO B
70 PRINT "(3 SPACES)-▒▀▄▀▄▀▄▀▄▀▄▀▄▀▄▀▄
▀▄▀▄▀▄"
80 PRINT
90 NEXT J
100 FOR K=1 TO 70
110 NEXT K
115 CLS
120 NEXT I
130 PRINT "HOW MANY SNAKES?"
140 INPUT D
150 IF D=C THEN GOTO 5
160 PRINT "THERE WERE ";C;" SNA
KES"
170 FOR I=1 TO 100
180 NEXT I
190 GOTO 5
```

Figure 4.

Change these lines
130 for u = 1 to 150
140 next u

Do not forget to delete line 150.

Figure 5.

```
1 LET S=0
5 PRINT
6 PRINT
7 PRINT
10 FOR I=1 TO 10
20 PRINT "▒(10 SPACES)▒"
30 NEXT I
40 LET A=(INT (RND*9)+1)
50 LET B=(INT (RND*9)+1)
60 FOR I=1 TO A
70 PRINT AT 15,I;"▌"
80 NEXT I
90 FOR I=1 TO B
100 PRINT AT 17,I;"▌"
110 NEXT I
120 LET S=S+1
130 INPUT D
135 IF D<>A+B THEN LET S=S-1
140 IF D=A+B THEN PRINT AT 3,S+
1;"■"
150 IF S=10 THEN GOTO 300
160 PRINT AT 15,1;"(12 SPACES)"
170 PRINT AT 17,1;"(12 SPACES)"
180 IF S=10 AND D=A+B THEN GOTO
400
190 IF D=A+B THEN GOTO 40
200 GOTO 60
400 PRINT "YOU BUILT A BRIDGE"
```

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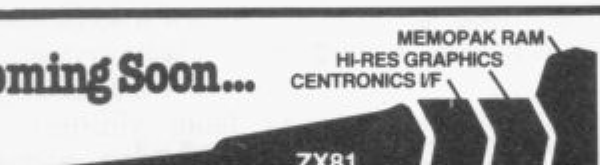
Memopak 64K Memory Extension

The 64K Memopak is a pack which extends the memory of the ZX81 by a further 56K, and together with the ZX81 gives a full 64K, which is neither switched nor paged, and is directly addressable. The unit is user transparent and accepts BASIC commands such as 10 DIM A(9000).

BREAKDOWN OF MEMORY AREAS

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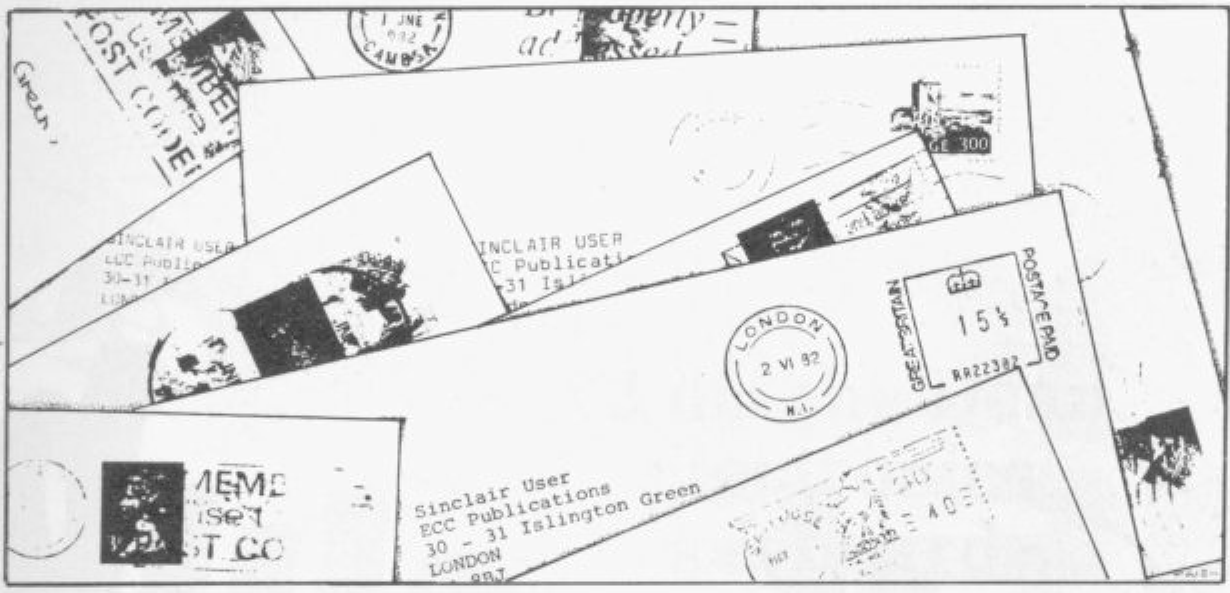
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Memory wobbles

MUCH has been written on the subject of RAM pack wobble, little of it giving any sound advice as to how it may be prevented. I feel that the three solutions which I have found are the best to date.

The Sinclair RAM would be as good as any other, except for the fact that it does not appear to be very eager to stay on the computer and will jump off when any key is touched hard enough.

If you have £2 to spare, you can buy a ribbon cable and solder one end to the RAM and plug the other to the edge connector of the PCB. That means that when you hit a key too hard, all that happens is that the ribbon cable absorbs the shock.

The second method is simpler and cheaper and just as effective. All that you do is to take a piece of Blutack and place it on the RAM, above the edge connector. When you plug in the RAM it is held to the computer by the Blutack.

The third way to stop RAM wobble, however, does not concern the Sinclair RAM but the Byg Byte RAM. Initially there is nothing wrong with the RAM and it is a very good alternative to the Sinclair RAM but the case is about three times the size it should be and so it pulls the connections apart. The answer is simple — just remove the case.

Giles Colborne,
Galampton,
Devon.

Stopping whiteouts

I WAS very interested in your article on the ZX-81 16K RAM pack, in particular the part which stated that the computer can suffer from whiteouts due to the fluctuations in the mains supply.

I have found that to be an annoying problem, especially when loading a program which takes more than four minutes to run.

I have heard that is due to the voltage spikes in the grid over-loading the memory and re-setting it to the input mode, leaving the mode K on my screen, which has happened to me.

I know that this is the problem, as the same tape and equipment will record perfectly during the times when the grid system is not being used a great deal; i.e., before 8.30 am and between 2 pm and 4.30 pm. It is not always convenient or possible to work on my computer at those times; mostly I like to work in the evenings, which can be the worst time for the problem.

I know that you can obtain a filter unit which goes between the wall socket and the computer plug which will suppress the spikes but I do not know which type would be best for my ZX-81.

Could you advise me as to which method of solving the problem you would suggest and where the goods can be obtained?

Paul Coker,
London SE19.

•*Can readers help? We are sending it to our Helpline correspondent, Andrew Hewson, to see if he knows the answer.*

Apple threat

I AM very grateful for the April issue of *Sinclair User* but it does not tell me how to make my printer work. The books which are sold do not tell you, either. It would be much better if you told people how a ZX-81 works, otherwise I shall have to sell mine and buy an Apple.

I write and write again to Sinclair, without even an acknowledgment.

Maurice Nadin,
Surrey.

•*We hope later issues have been more help and that you have not been compelled to take the drastic step of buying an Apple.*

Changing to machine code

CONGRATULATIONS on an excellent magazine. It is just what ZX users wanted. I am not a programmer and prior to buying my ZX I did not have a clue. Through practice, I am rapidly picking-up the techniques and find the hobby very interesting. I find, having bought some programs written in machine code, that they are eminently superior to anything I have written, or purchased, written in Basic. To you, that may be an obvious statement but it has become clear to me only on running them.

What I would like to do is to understand machine code — of which I now understand the basic principles — and, if possible, to buy a program which could convert some of my many Basic programs into machine code. Is that possible?

From your advertisements there are one or two firms offering products which look as if they may answer the problem — Control Technology, Bug Byte, to name two — but they do not give sufficient detail for me to decide.

I am told that what I am really looking for is a Compiler but I have not yet seen anything advertised as such. Does one exist? Can you recommend any good books or a contact with whom to discuss the matter?

D R Wall,
Manchester.

•*Do readers have any advice? Meanwhile, we have passed the query to Andrew Hewson, our Helpline correspondent.*

•Letters should be kept as brief as possible and addressed to The Editor, *Sinclair User*, 30-31 Islington Green, London N18BJ. Space considerations mean that it may be necessary to edit long letters.

The Sinclair User Club

AS A FURTHER service to users of Sinclair computers, *Sinclair User* is starting the Sinclair User Club.

Membership will cost £12, which will enable members to enjoy a large number of extra benefits. They will include a bi-monthly cassette-based newsletter containing programs and answering problems, and many special discounts on a variety of goods of interest to ZX owners.

Sinclair User will also contain stories about the club and its activities in each issue.

It is intended to build-up the number of items which will be available at special prices to club members, with a Star Offer each month.

Readers wishing to share the benefits of membership of the Sinclair User Club should complete the form below.

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For this month's bargain, open only to members of the Sinclair User Club, we are offering to reduce the price of what many people consider to be the best keyboard available for the ZX-81, the Dean Electronics keyboard.

It is simple to fit, plugging straight into the ZX-81 after the built-in keyboard has been unplugged. It has 47 keys, six more than the ZX-81. The extra keys can be used for whatever the owner wishes.

The normal price is £35 but we are able to offer the keyboard through Buffer Micro Shop for only £32. In addition, the case, which usually costs £14.50, is offered at £13.50.

Membership cards must be shown or numbers must be quoted when taking advantage of the offer, which closes on July 31.

Buffer Micro Shop is at 374A Streatham High Road, London SW16, next to Streatham Station.

Each month *Sinclair User* will be listing, free, the growing number of ZX user groups throughout the world.

We hope the list will be comprehensive and if anyone is forming a new group or knows of one we have not included, please let us know.

Britain

Aylesbury ZX Computer Club: Ken Knight, 22 Mount Street Aylesbury (5181 or 630867). Meetings: first Wednesday and third Thursday of the month.

Edinburgh ZX Users' Club: J. Palmer (031 661 3183) or K Mitchell (031 334 8483). Meetings: second Wednesday of the month at Claremont Hotel.

EZUG-Educational ZX-80/81 Users' Group: Eric Deeson, Highgate School, Birmingham B12 9DS.

Glasgow ZX-80/81 Users' Club: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow G76 7LW (041 638 1241). Meetings: second and fourth monday of each month.

Hassocks ZX Micro User Club, Sussex: Paul King (Hassocks 4530).

Inverclyde ZX-81 Users' Club: Robert Watt, 9 St. John's Road, Gourock, Renfrewshire, PA19 1PL (Gourock 39967). Meetings: Every other week on Monday at Greenock Society of the Deaf, Kelly Street, Greenock.

National ZX-80 and ZX81 Users' Club: 44-46 Earls Court Road, London W8 6EJ.

North Hertfordshire Home Computer Club: R Crutchfield, 2 Durham Road, Stevenage; Meetings: first Friday of the month at the Settlement, Nevells Road, Letchworth.

North London Hobby Computer Club: ZX users' group meets at North London Polytechnic, Holloway Road, London N7 each Monday, 6pm.

Nottingham Microcomputer Club: ZX-80/81 users' group, G E Basford, 9 Holme Close, The Pastures, Woodborough, Nottingham.

Orpington Computer Club: Roger Pyatt, 23 Arundel Drive, Orpington, Kent, (Orpington 20281).

Post Office Users' Club: Vernon Quaintain, Head Post Office, St Martin's le Grand, London, EC1.

Scunthorpe ZX Club: C P Hazelton, 26 Rilestone Place, Bottesford, Scunthorpe; (0724 63466).

Worle Computer Club: S W Rabone, 18 Castle Road, Worle, Weston-super-Mare BS22 9JW (Weston-super-Mare 513068). Meetings: Woodsprings Inn, Worle, on alternate Mondays.

ZX Aid: Conrad Roe, 25 Cherry Tree Avenue, Walsall WS5 4LH (Walsall 25467) to cover Walsall and West Bromwich area.

ZX-80/ZX81 Users' Club: PO Box 159, Kingston-on-Thames. A postal club.

Overseas

Belgium, France Luxembourg: Club ZX-80/81, Roger Betz, Chemin du Moulin 38, B-1328 Ohain, Belgium; (322 6537 468).

Denmark: Danmarks National ZX-80/81 Klub (DNZK), Jens Larson, Skovmosevej 6.4200 Slagelese, post giro 1 46 24 66.

East Netherlands: Jonathon Meyer, Van Spaen Straat 22,6524 H.N. Nijmegen; (080 223411).

Germany: ZX-80 Club, a postal club; contact Thomas Jenczyk. Hameln, Postfach 65 D-3250 Hameln, Germany.

Indonesia: Jakarta ZX-80/81 Users' Club, 73 Cnoc Crionain, Baile Atha, Cliath 1.

Spain: Club Nacional de Usuarios del ZX-81, Joseph-Oriol Tomas, Avda. de Madrid, No 203 207, 10, 3a esc. A Barcelona-14 Espana.

United States: Bay Area ZX-80 User Group, 2660 Las Aromas, Oakland CA94611. — Harvard Group, Bolton Road, Harvard MA 01451; (617 456 3967).

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QUOTES

"Michael Orwin's £5 Cassette Two is very good value. It contains 10 stolid well designed games which work, offer plenty of variety and choice, and are fun."

From the ZX Software review in
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"I had your Invaders/React cassette . . . I was delighted with this first cassette."

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(eleven 1k programs)

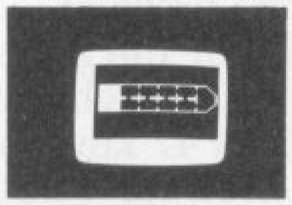
machine code:
React, Invaders, Phantom aliens, Maze of death, Planet lander, Bouncing letters, Bug splat.
Basic:
I Ching, Mastermind, Robots, Basic Hangman. PLUS Large screen versions of Invaders and Maze of Death, Ready for when you get 16k.
Cassette One costs £3.80

CASSETTE 2
Ten games in Basic for 16k ZX81

Cassette Two contains Reversi, Awari, Laser Bases, Word Mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.
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CASSETTE 3
8 programs for 16k ZX81

STARSHIP TROJAN

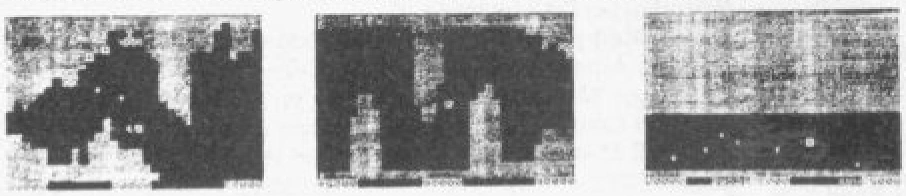


Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

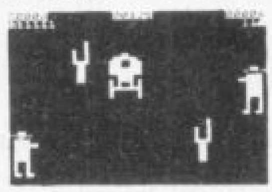
STARTREK This version of the well known space adventure game features variable Klingon mobillity, and graphic photon torpedo tracking.
PRINCESS OF KRAAL An adventure game.
BATTLE Strategy game for 1 to 4 players.
KALABRIASZ World's silliest card game, full of pointless complicated rules.
CUBE Rubik Cube simulator, with lots of functions including 'Backstep'.
SECRET MESSAGES This message coding program is very txlp qexi jf.
MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and its top speed is very fast.
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CASSETTE 4 7 games for 16k ZX81

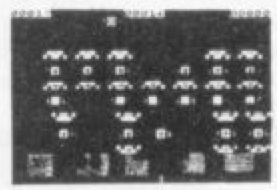
ZX-SCRAMBLE (machine code) with 3 stages.
Bomb and shoot your way through the fortified caves.



GUNFIGHT
(machine code)



INVADERS
(machine code)



GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft to fight off.
SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed. (very fast at top speed).

LIFE (machine code)
A ZX81 version of the well known game.
3D TIC-TAC-TOE (Basic)
Played on a 4 × 4 × 4 board, this is a game for the brain. it is very hard to beat the computer at it.

6 of the 7 games are in machine code, because this is much faster than Basic. (Some of these games were previously available from J. Steadman). Cassette 4 cost £5.

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COMPREHENSIVE USER MANUAL INCLUDED IN PRICE

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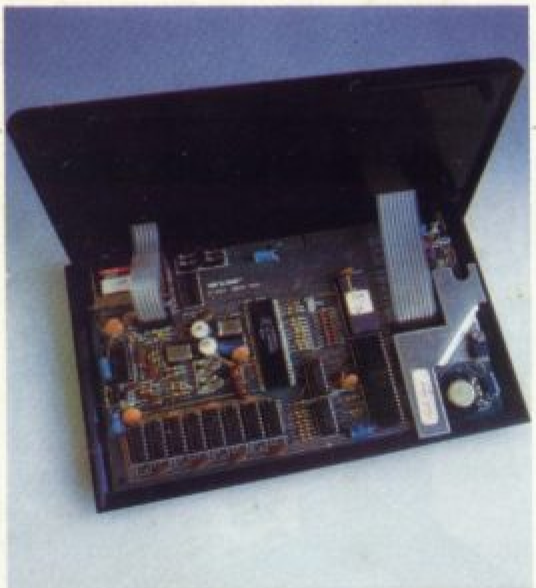
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Stephen Adams looks inside Sinclair's latest machine and finds it has a lot in common with the ZX-81

Taking the lid off the Spectrum

THE ZX SPECTRUM is very similar in shape and style to the ZX-81 and there are many similarities. Sinclair has kept the original keyboard to save space but has provided a rubber sheet with moulded keys on it which fits over the top. The sheet is suspended over the flat keys — which on the ZX Spectrum are bigger than the ZX-81 — so that when a key is pressed it bends to give some feel to the keyboard.

That and the fact that the keys repeat if held down for longer than one second, even when using SHIFT, makes the keyboard much easier to use. The single keyword system has been retained and that saves memory, as all the Basic words can be stored as one byte. It also means that two SHIFT keys are required to reach all the functions; one is called CAPS SHIFT and the other SYMBOL SHIFT. They are at opposite ends of the keyboard and as they are often used one after another, it tends to slow the input speed as you are constantly swapping hands.

For instance, RUBOUT and the cursor movements use CAPS SHIFT and +-* are SYMBOL SHIFT. It would have been a better idea to put both on the left-hand side, as they often need to be used together and could be pressed with one hand while the other searches for the appropriate key.

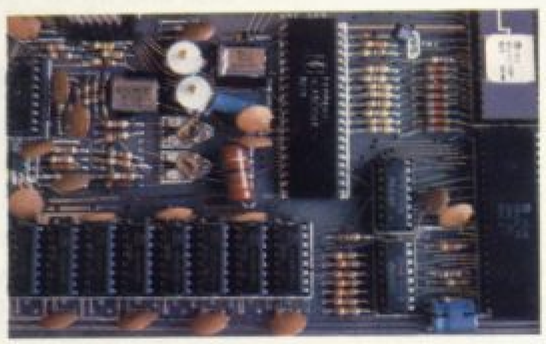
'The Spectrum is real value for money and easy to use. It has some peculiarities but they do not seem important when you look at what it can offer'.

The keyboard is an input-output mapped device, as on the ZX-81, and along with the the ZX printer, which is the same for the ZX-81 and the Spectrum network/RS232 interface, discs, loudspeaker, tape interface and border colours require only one address line to work. That means that you must make all of the lower five address lines a binary 1 to use your own devices.

The input-output map access has been improved greatly, however, with the addition to the Basic commands of IN and OUT. They give an instruction IN A(c) or OUT A(c) where registers BC give an address from 0 to 65535.

The memory-mapped addressing of the RAM/ROM occupies 0-16K and the RAM 16K-32K on the basic 16K model. There is provision for an extra 32K board to be plugged in to IC sockets at the back of the printed circuit board. The 48K version will have the board fitted but to add it later it will cost £60, which I think is expensive.

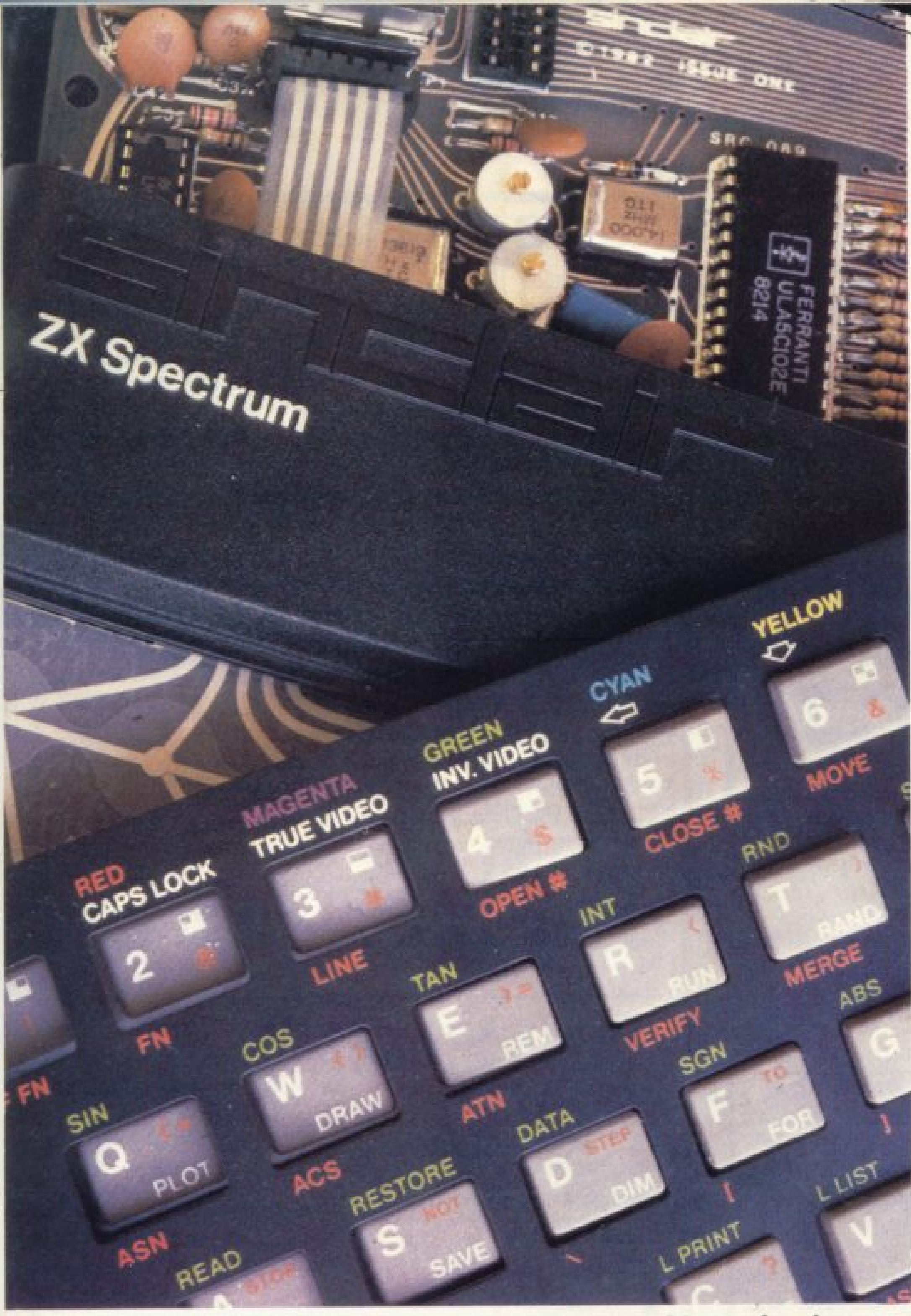
There would be no difficulty in adding extra ports to the memory map, as on the ZX-81, above 32K — on the basic version — but for two things. There is no RAM CS line, so that the extra RAM can be turned-off if required on the edge connector and the edge connector address lines have been moved to the outer edges so that it is incompatible with the ZX-81. The Spectrum has a 28-way double-sided edge connector of the same style as the ZX-81, with the keyway on pin 5. That makes any input-output device compatible with the ZX-81 but any memory-mapped devices would have to be rearranged. The edge connector also has a number of new



signals on it which are not explained in the manual, plus a video output and colour outputs for VDUs.

All the voltages used on the Spectrum are also brought out, namely + 5V, -5V, + 12V and -12V. They are obtained from the same buzzing transformer as is used in the 16K RAM pack and most of that RAM pack seems to have been transplanted on to the Spectrum.

The obvious additions to the circuitry are the PAL colour mixer under the metal can which contains the video modulator and the fact that two crystal-controlled oscillators are used, one for the ULA, which controls the screen among other things, and the other for the colour mixer. The 14mHz clock for the ULA is also used to drive the Z-80A microprocessor after it has been reduced to 3.5mHz. That is 0.25mHz faster than the ZX-81. The Z-80A has also been



freed of the job of putting-out the screen — by the ULA — and so no longer requires the commands FAST or SLOW, as it works at top speed all the time except when BEEP or PAUSE is used.

PAUSE and BEEP both cause the Z-80A to stop for a time determined by the programmer and so it will do nothing else while those commands are being done. BEEP commands should be kept short in a program for that reason; 0.01 seconds is a good speed to PRINT AT and BEEP at the same time.

As for programming the Spectrum, it can be considered as an extension of the ZX-81 Basic. The PAPER, INK, BRIGHT and FLASH commands for each character square are stored in a memory map above the dots for each character. They are all stored in one byte per character and can be read by the Basic word ATTR and altered either by Basic commands or POKEs.

The dot screen is a different matter, however, and cannot be altered so easily, as the dots are stored in peculiar order, so you have to use the graphics commands — which can define all the dots on the 22 line by 32 character screen available to the user — or the SCREEN command.

There can be only two colours for each character square, one for the foreground (INK) and one for the background (PAPER), but they can be any one of eight colours. They can also be inverted at a rate of one per second continuously, square by square (FLASH) or have two intensities of colour (BRIGHT).

The screen takes up 6,912 bytes of the 16K memory and the system variables take up another 738 bytes. The rest of the memory is not free for the user to use as 11 other areas float above location 23733 and can expand and contract as required by the Spectrum.

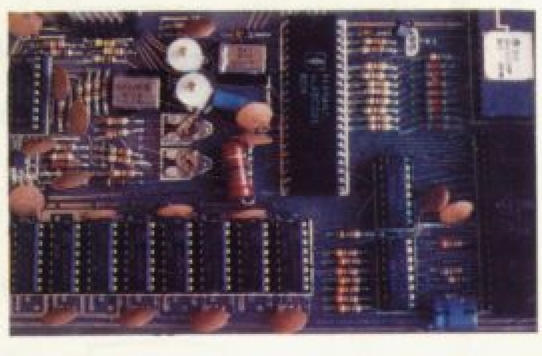
The program and variables are sandwiched in the middle of those, so REM statements cannot be used for machine code. There is an area, however, which can be used for machine code programming above RAMTOP which is ignored by the Basic and its length can be defined by the user.

The user-definable characters area is stored above that so they can be kept from program to program.

There are many tape arrangements which can be made with the Spectrum. The program, strings or machine code can all be SAVEd, LOADed and VERIFYd separately. The variables and screen can also be stored on tape but cannot be VERIFYd. As each is SAVEd, a messsage to start the tape recorder will appear and wait for you to press a key. That is a very good example of the user-friendliness of the machine and most of the errors appear with similar messages.

SAVEing or LOADing causes the border to flash red and green or red and blue, depending at which part of the tape you are looking. All of my tape programs LOADed correctly and I was surprised with the the difference in speed between it and the ZX-81.

I have been able to deal with only a few subjects. There is so much more to learn about the Spectrum from the manual that it would

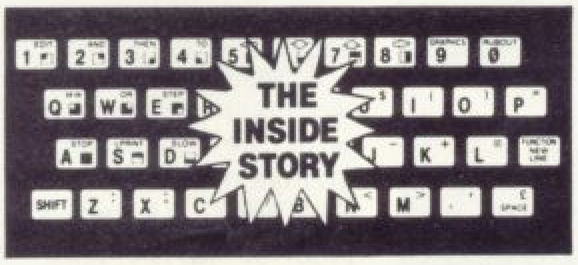


become a series if I did not stop now.

The Spectrum is real value for money and easy to use. It has some peculiarities but they do not seem important when you look at what it can offer. With disc, networking facilities and RS232 interface it is a great improvement on the ZX-81 but it cannot replace it, as the price of £129.95 will still be a little daunting to those who want to try a computer for the first time.

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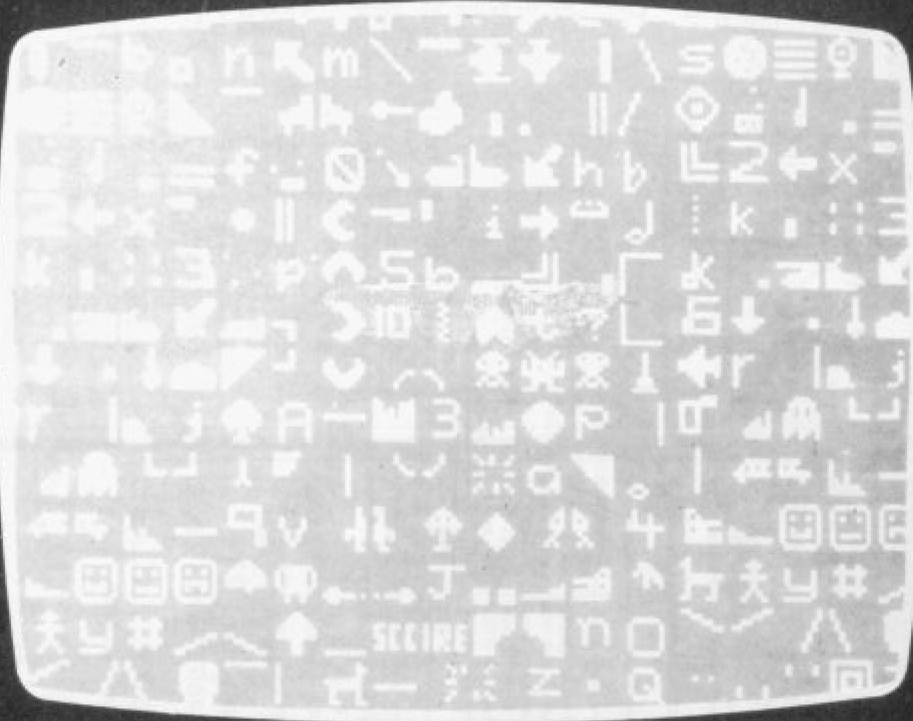
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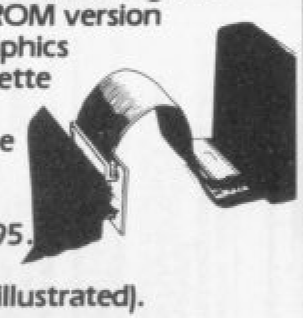
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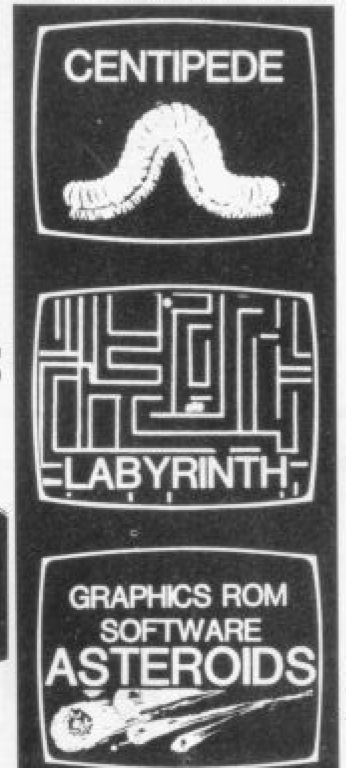
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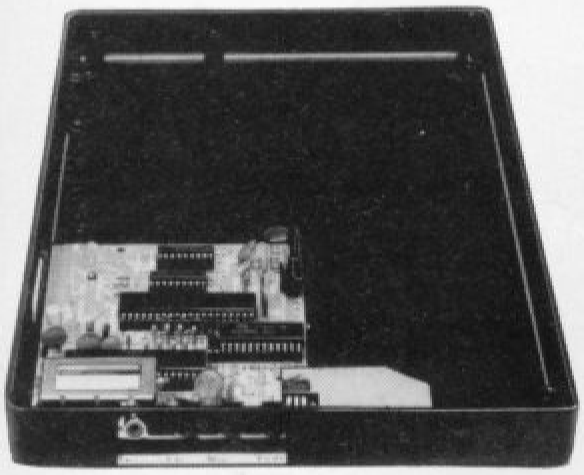
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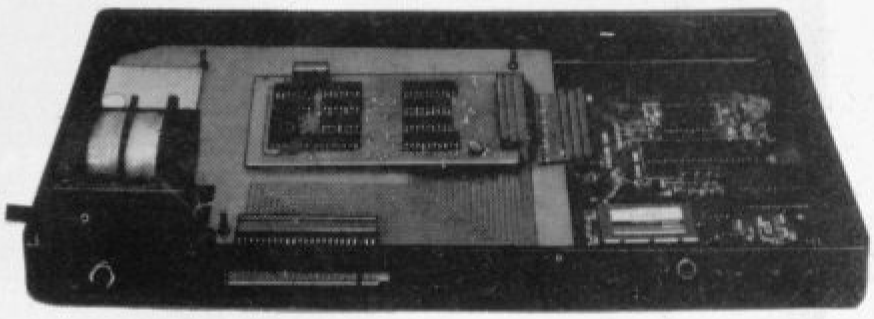


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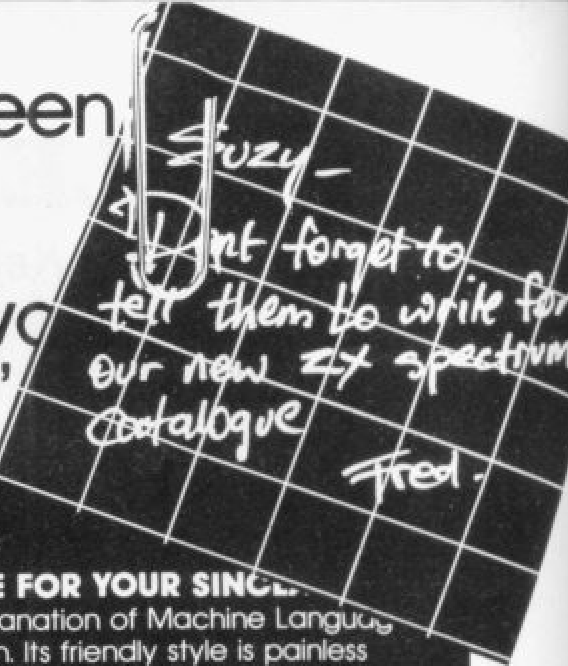
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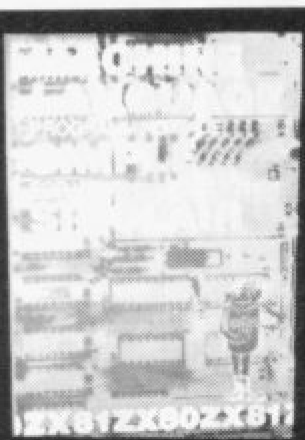
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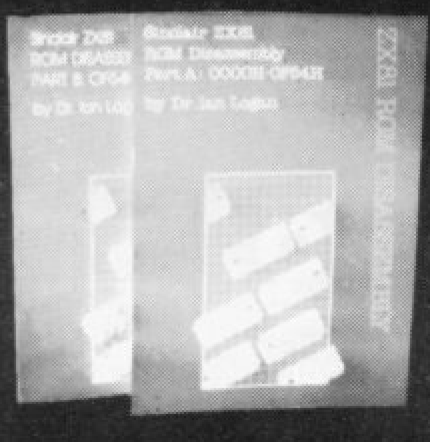




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SU



Smith adds to micro range



John Rowland, market development manager of W H Smith

W H SMITH expects to be selling another computer by the end of the year. It is talking to a number of manufacturers about stocking their micros to add to the ZX-81 which it began selling last September.

John Rowland, market development manager, is giving nothing away about which machine it might be but expects a decision to be made in August.

It is the next major step in the company's move into the home computer market, which it sees as a major growth area. It is already extending the number of branches selling computer goods and increasing the amount of selling space, particularly in the larger branches.

"We sell 50 lines of software and are increasing that all the time. We think we are ready to take the next step in offering a new machine," Rowland says.

He added that when the new product is launched it is hoped it will be accompanied by a full range of software. He expects that by next year the company will be selling more than 100 lines of software.

Rowland says that in the next few years W H Smith would probably like to sell about three machines with a full range of hardware add-ons and software. After that, he thinks the market will probably go the same way as the record market, with some retailers concentrating on hardware and others on software.

Of the hardware market, he says that Smith's entry will depend on manufacturers agreeing to a standard interface. Without that it would not be possible to generate sufficient sales to make it worthwhile. The retailer is looking for high-volume sales, which is why it chose to enter the market with the ZX-81.

Rowland added that Smiths is also looking at the possibility of becoming a software publisher. The company already receives many suggestions each week.

ZX fairs spread to North

THE FIRST exhibition for ZX users to be held in Birmingham is attracting a great deal of interest, despite its clash of dates with the Personal Computer World show in London. The organiser, Eric Deeson, says that about 40 of the major companies in the market are taking space.

The idea for Microscene Brum 82, on Saturday, September 11, resulted from the successful ZX Microfairs in London.

"Many people said how inconvenient it was having to go to London so we thought we would try for a regional show," Deeson says. He is hoping to attract people from all over the Midlands and further north.

Meanwhile a general microcomputer fair is being held at Manchester on July 24 and 25. It is being held in conjunction with the University of Manchester Institute of Science and Technology at Sackville Street, Manchester and is aimed at the education and small business markets.

Clive to run in half-marathon

CLIVE SINCLAIR's energy seems to be endless. Not only is he able to mastermind one of the most successful computer companies in the world — he has enough strength left to run marathons.

He has already run one distance of more than 26 miles and now he is to take part in a half-marathon being organised as part of the 1982 Cambridge Festival.

Sinclair Research is sponsoring the event with £5,000 and it is expected that 2,000 competitors will be taking part, including a number of top-class runners.

The race will be held on Sunday, July 18 and will follow a course through the city's historic streets.

The company, which is based in Cambridge, sees the sponsorship of the race as part of supporting the cultural life in the city. It will also be sponsoring a concert in King's College, Cambridge as part of the festival.

Brain power wins ZX-81s

TWENTY-THREE regional winners in this year's Mensa Superbrain competition have been awarded ZX-81s. The awards were prompted by Clive Sinclair's involvement with the British Mensa Society, of which he is chairman.

The competition is an annual event and is set to be a test of intelligence rather than memory, as in Mastermind and Brain of Britain. It is usually run in conjunction with provincial newspapers on a regional basis, with the regional winners proceeding to the final. This year, for the first time, extra sections were organised through the independent local radio network, which provided five regional winners.



Radio Sinclair

There seems to be no limit to the uses which can be found for the ZX-81 Here Julian Moss reports how it has been of help in amateur radio.

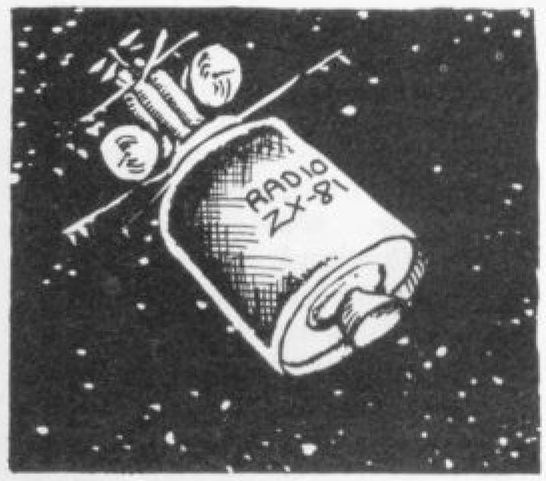
AMATEUR RADIO is a hobby as old as radio itself. Ever since Marconi sent the first transmission across the Atlantic, radio amateurs have been experimenting with new modes of communication and, in the process, making friends across the world.

Many of today's radio amateurs use commercially-made equipment but there is still a good deal of experimenting, in aerial design for example, and at very high frequencies. Like any technical hobby, there are many uses for a computer and the ZX-81 has found its way into many radio shacks. Its uses fall primarily into three areas — information storage and retrieval, mathematical and scientific programs, and real-time on-the-air applications.

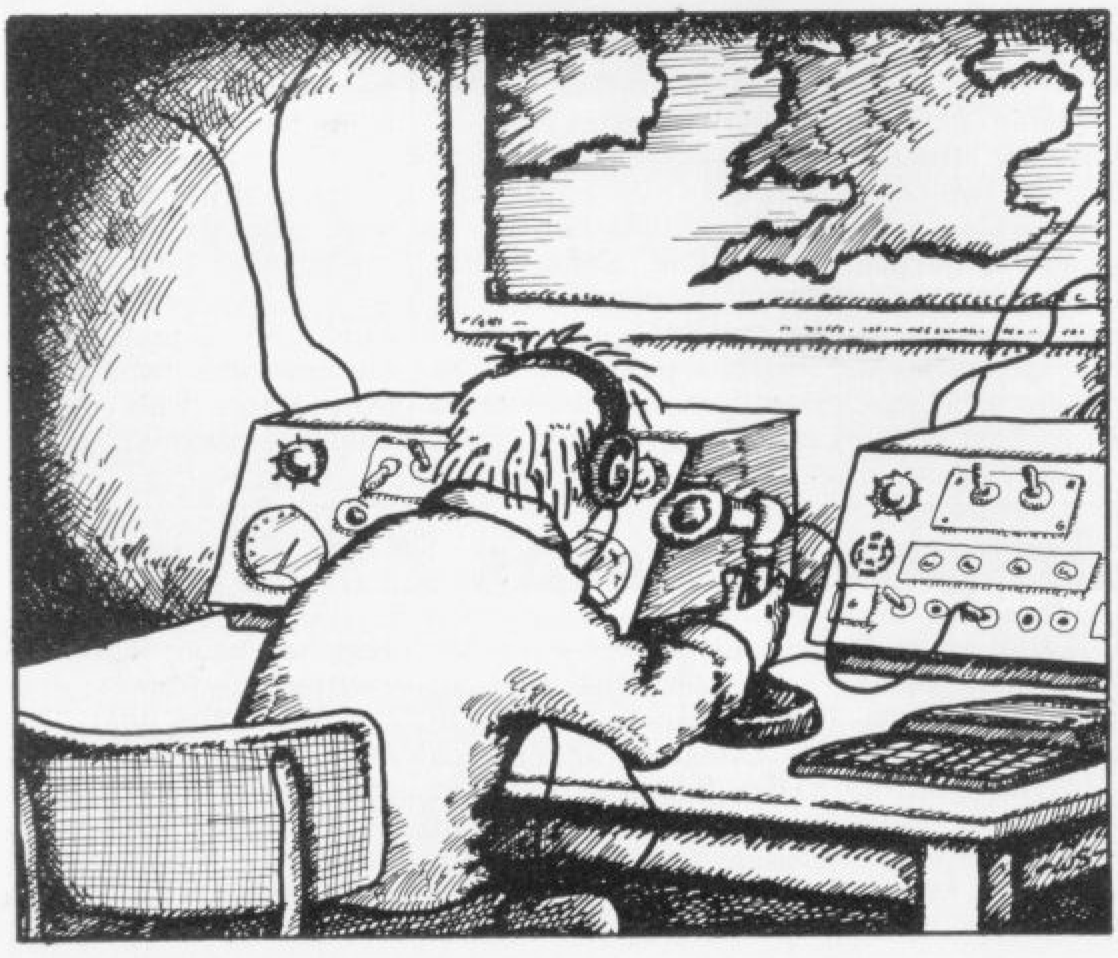
Programs in the first category are fairly straightforward. One example is an index of radio stations contacted or heard. Every radio amateur has his own call-sign, in which the first two or three characters denote the country — for example, the G4 in the call-sign G4ILO indicates England. Since a typical ham may make thousands of contacts in a year, it is impossible to remember every one.

By storing on the computer each call-sign, along with the operator's name, town, the date and perhaps other details, it is possible to recall immediately whether or not a station has been contacted previously and to see the details of the contact.

The data can be sorted into call-sign order, to see how many countries have been contacted — useful since many amateurs compete for certificates which are awarded for contacts with, for example, 100 countries.



Another use for the computer is to compile an index of technical articles in radio and electronics magazines. Most radio amateurs, like home computer enthusiasts, accumulate magazines devoted to their hobby. It is frustrating to search issue after issue looking for an article you remembered reading a few months ago. If a description of each article is stored in the computer, together with the name of the publication, its issue date and the page number, it is possible to have a program which will search the descriptions and produce a list of all the articles relating to a particular topic. Typically, more than 300 references can be stored on a 16K ZX-81.



Another facet of amateur radio is contests. On some weekends, amateur operators from all over the world try to make as many contacts as possible in a given period, usually 24 hours. The scoring varies from contest to contest but usually is based on the number of contacts made and the number of country



prefixes, or even the total distances over which the contacts were made.

Keeping the score is an ideal job for a computer, which can also log each call-sign and display a message if a station has been contacted previously in the contest.

On the technical side, there is a vast number of uses for the ZX-81. Two examples are aerial design, when the computer can be used to work-out the dimensions of an aerial for a particular frequency, and even to calculate its theoretical performance; and the design of electronic circuits.

American magazines publish programs of that nature frequently. Those programs are usually written for the most popular home computers in the U.S., such as the TRS-80, but it is fairly straightforward to convert them to run on the ZX-81, the main differences being that the TRS-80 does not require the word LET in an assignment statement and that it allows multiple statements on one line.

Another popular application is Oscar tracking. Oscar stands for Orbital Satellite Carrying Amateur Radio. It is a satellite designed, built and paid for by radio amateurs, and launched by NASA on their behalf. The satellites pick up amateur transmissions on one frequency and re-transmit them on another, allowing communication over distances which might otherwise not be possible.

To use Oscar, it is necessary to know where it is at any given time and so a program can be used to predict when the satellite is 'visible' from a location and in which direction to point the aerials.

'The computer can be used on-the-air to send and receive Morse code and radio-teletype signals'.

One problem which radio amateurs soon encounter when they put a computer in the shack is interference. The ZX-81 radiates a good deal of radio noise, which is picked up by the receiver and can easily obliterate weak signals. Usually it is necessary to screen the case carefully, using aluminium foil, and to filter the lead from the power supply. The RAM pack must be screened as well.

The reverse of that situation can also occur, when RF from the transmitter interferes with the operation of the computer. This is not usually a problem with the ZX-81, however, although the television used for the display can be affected sometimes.

Once those problems have been overcome, the computer can be used on-the-air to send and receive Morse code and radio-teletype signals, and even to control the station. Many of the new amateur radio transceivers use a microprocessor to control the various functions such as frequency and mode, and the various control lines are brought out to a socket at the back.

Using a suitable interface, it would be possible to program the ZX-81 to scan selected frequencies, perhaps to record whether or not a signal is present, to build a picture of amateur band activity at various times of the day, or to monitor the strength of particular distant stations. It would even be possible to program the computer to scan the band for stations using Morse code and reply to them automatically.

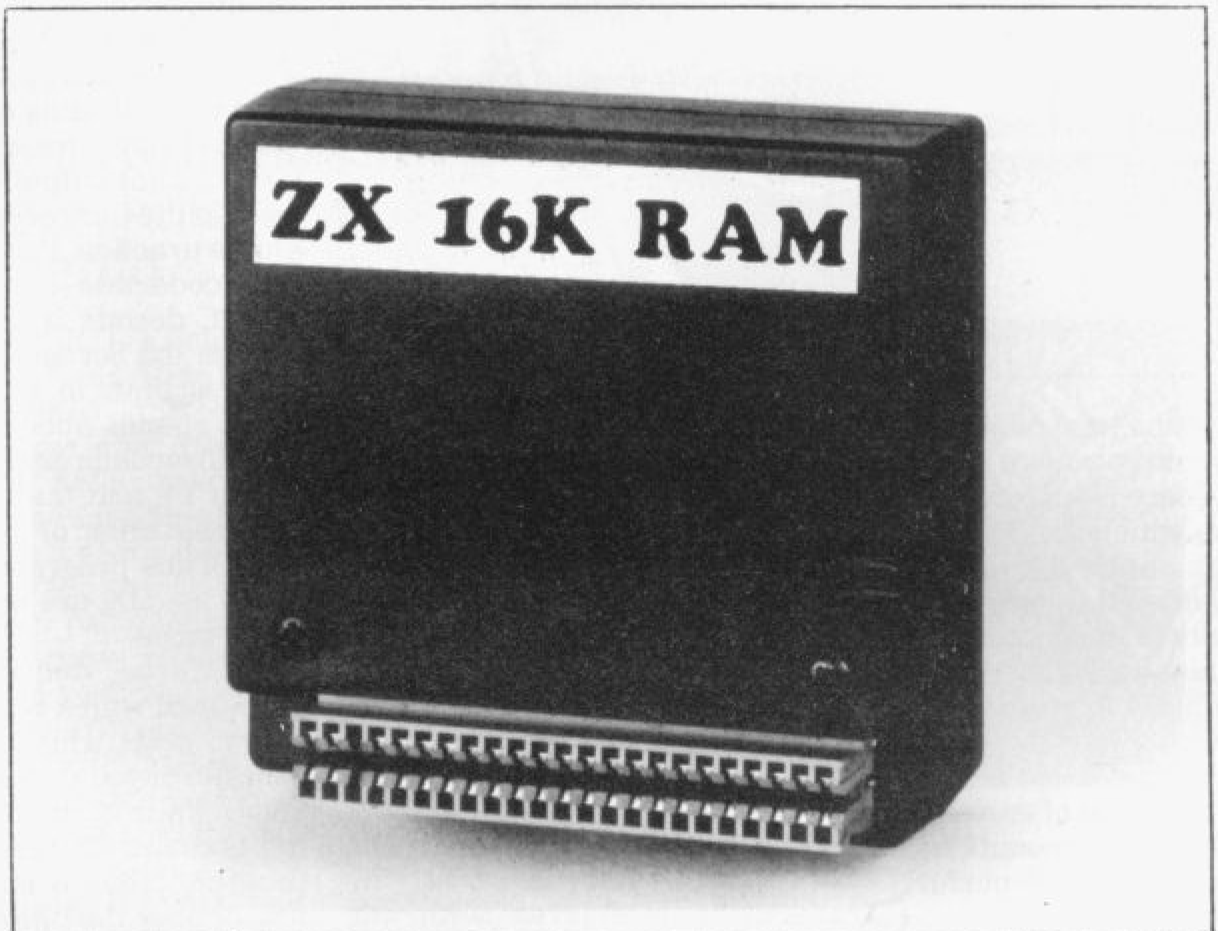
It is possible to generate Morse code without using additional hardware, using the cassette output socket. That output can be fed into an amplifier, or recorded on tape for Morse practice. It is also possible to feed code into the cassette input socket, decode it, and display the text on the screen. The main difficulty is that, in SLOW mode, the ZX-81 spends about 15 out of every 20 milliseconds displaying a picture on the TV and that interferes with the generation or reception of the code. Thus programs for Morse or RTTY usually are written to run in FAST mode.

A Morse decoder has been developed which will display on the screen code which is fed into the cassette input socket at a suitable level. Since it runs in FAST mode, the text can be read only once the program stops when the screen is full, or once the BREAK key is pressed. Noise and interference will upset the decoding and the signal should go ideally through a narrowband filter, so that only the wanted signal is fed into the ZX-81.

The program uses a short USR routine to read the cassette input port. The routine is 24 bytes long and is stored in the first REM statement of the program. The easiest way to enter the routine is to type-in a REM with 24 characters in it and then to POKE into locations 16514 to 16537 the values given in the table following the program listing. The routine returns a value of O if no signal is present at the input port, or a positive number if one is present.

There is a Sinclair Amateur Radio Users' Group in the U.K. Anyone interested should contact Paul Newman, G4INP 3 Red House Lane, Leiston, Suffolk, IP16 4JZ, enclosing a stamped addressed envelope for details.

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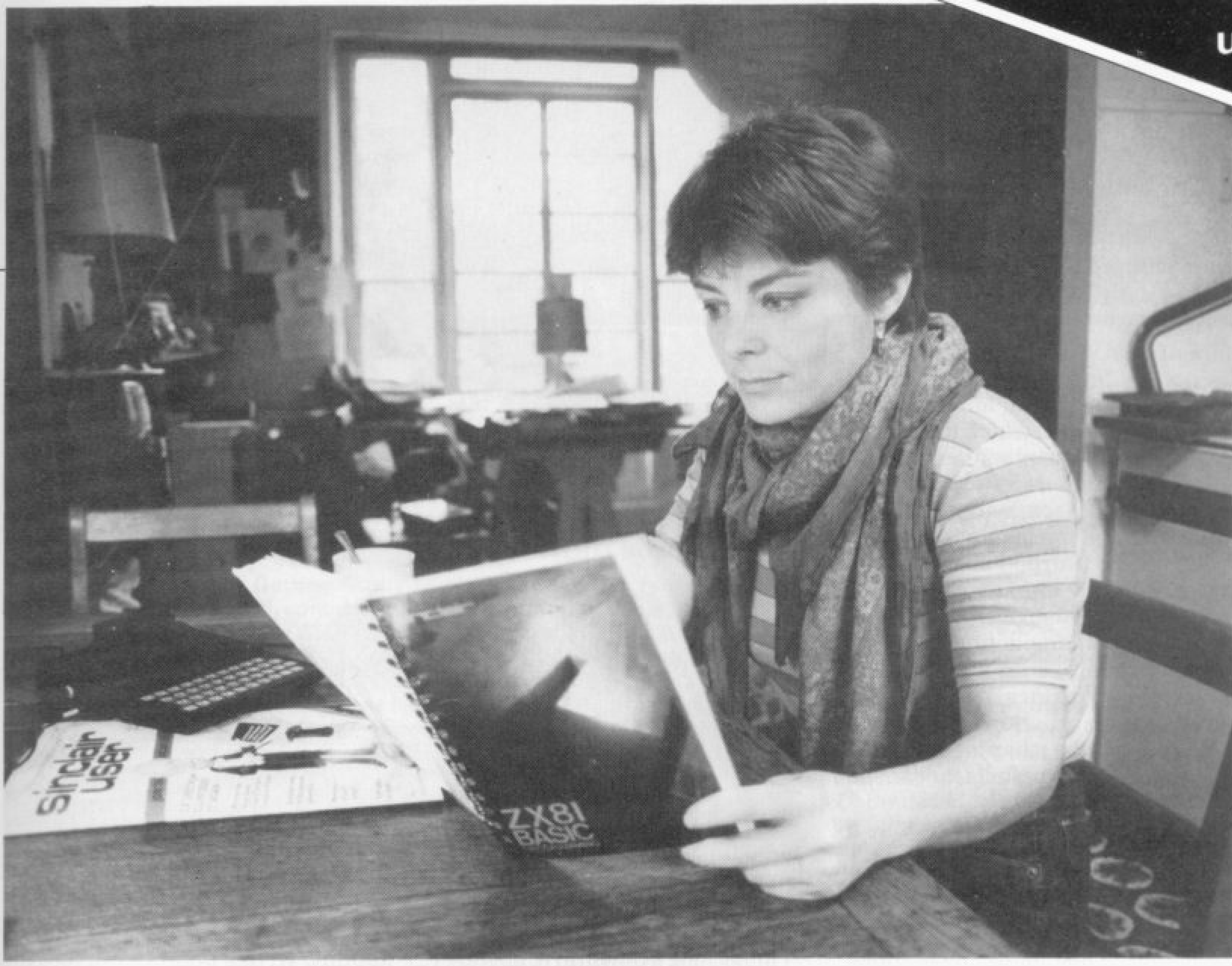
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Nicole Segre finds that, despite her reservations, understanding the ZX-81 is only a matter of time.

Discovering the adult charms of the ZX-81

I COMPLAINED at some length last month about the upheavals caused in the household by my son's purchase of one small, seemingly innocuous electronic machine called a ZX-81. What distressed me most was that he and his friends, all mere babes in arms, seemed possessed of a technical skill and expertise with regard to computers which left me feeling decidedly passé.

I have determined to remedy all that. It is important, in my view, not only to keep up with the times but to teach all those uppity youngsters not to under-estimate their mothers. Accordingly, I waited for a short pause between a game of **Star Bash** and a game of **Clonk!** and obtained my son's permission to tinker with his Sinclair during those hours when attending to his education kept him away from more pressing matters. "Is there anything I must not do?" I enquired anxiously. "No, it's all right," he said. "Computers are idiot-proof."

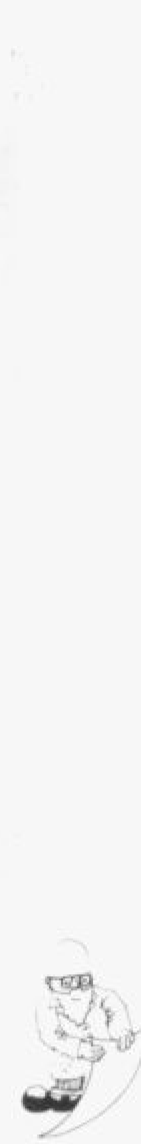
Letting that go, I set to work the next morning and I made an astonishing discovery — it's easy. All you have to do to use a ZX-81 is fellow the instructions and, believe me, if I can follow the instructions, anyone can. To be honest, I am a wonderful human being with many precious gifts but a way with inanimate objects is not one of them.

So far as I am concerned, sexual equality stops short of changing tyres or replacing washers and, as for electricity, I am like the man who thought there was cold electricity for refrigerators and coloured electricity for traffic lights.

Yet in no time at all I was able to use a sophisticated piece of equipment, even to the extent of programming it to tell a silly joke. Now, I am just letting-up before racing on to looping, graphics and organisation of memory, which sounds just the kind of thing I need.

Having said that, however, I can admit freely that it has not all been plain sailing. In fact, at first it seemed as if the whole self-improvement plan would never get off the ground. A 13-year-old's bedroom is probably not the best place to conduct an important research project of this kind and my son's bedroom possesses sufficient electrical wiring to knit a fisherman's sweater.

continued on page 26







continued from page 25

You are ready to begin, the manual said, when a K appears in the bottom left-hand corner of the screen but for that to happen I had to find the socket in which to plug the socket in which to plug the plug.

Several hours later, I emerged, hot and dusty, from under the bed, and there was the magic K. Fingers at the ready, I turned once more to the excellent manual, which I cannot praise enough for its clarity and wealth of incidental detail. I had no difficulty with adding 2 + 2, cursors, the history of computer languages and how to erase mistakes but the chapter on using the computer as a calculator caused a twinge of anxiety.

I don't even use a calculator as a calculator. I know what a square root is, and even pi, although I cannot remember when I last used it; but integers and exponential functions? They must have done those while I was away from school with chicken pox. Anyway, having managed without them for so long, I thought I might continue to do so and skipped to the next section.

That looked more promising, being all about the price of eggs. Those I do use and although I can usually work out their price, give or take a few pence, in my head, it amused me to let the computer do it. It could even, the manual said, tell me the square of the cosine of the price of one egg, should I ever want it. Well, you never know. I was glad, too, that the manual catered for the eventuality of my housekeeper rushing in, full of concern, and crying in that delightfully old-fashioned way of hers: "Glory be, eggs have gone up to 61 pence a dozen."

What worries me, though, is how am I going to tell the kind soul that, thanks to my handy little computer, I shall soon be able to dispense with her services?

Things took a downturn, however, with the price of butter and yeast. Having missed a vital piece of information about semi-colons — buried treacherously as I later discovered in that frightening mass of higher mathematics — I suddenly lost control. A stern S — for Stupid? — kept appearing to say I had it all wrong and when I attempted to put it right, everything went from bad to worse.

The trouble is that I am used to a typewriter keyboard, not one which moves things about and has about 12 instructions per key and erases backward to boot. I knew you could pull out the plug and start again but that seemed a little drastic. It reminded me of my one and only ski-ing holiday when learned to negotiate a slope, more or less, but not to stop. To do that, I would throw myself into the first convenient snowdrift but I always thought there must be a better way.

'Unnecessary though a ZX-81 may be, what a marvellously clever and obedient little chap it is'

Eventually, it all came clear to me and I was chugging along again happily. At one point I even thought that, together, the computer and I would crack that eternal problem of the length of a piece of string but it proved to be more a matter of whether Mr Smith was shorter than Mr Smythe. I don't think I had that correct. By then my earlier struggles had worn me out and, besides, there was a good film about to start on the other channel.

My studies may not be very advanced but I see now how one could become very involved in all this. From the start, I have wondered what possible use a computer such as my son's could be and I still don't know — but who cares? Pressing buttons is fun.

Unnecessary though a ZX-81 may be, what a marvellously clever and obedient little chap it is. Do this and do that, the manual says, and the computer will do this and do that — and it does what else in life is so simple and so satisfying?

Anyway, I could not stop now. All kinds of fascinating things have caught my eye — measles programs, Venusians with eight fingers and no thumbs, flowcharts — and I must investigate. If anyone wants me in the next few days, please speak to the housekeeper.

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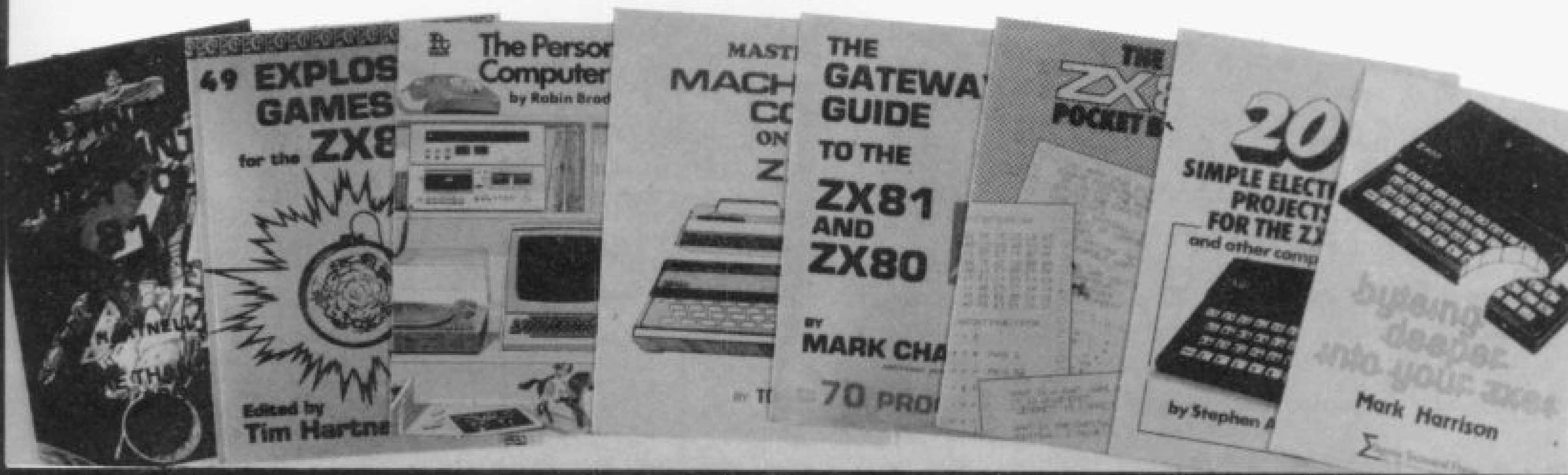
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ZX/1

Reader survey

1 Into which range does your age fall?

Under 16 ☐ 16-25 ☐ 26-35 ☐ 36-45 ☐ 46-55 ☐ 56-65 ☐ Over 65 ☐

2 Are you in employment? yes/no

If yes, give type of employment. . . . .

If no, state whether student, retired, or whatever. . . . .

3 Into which ranges does your income fall?

Less than £5,000 ☐ £5,000 to £10,000 ☐ £10,000 to £15,000 ☐ £15,000 to £20,000 ☐

More than £20,000 ☐

4 Do you own a Sinclair computer?

Which one? ZX-80☐ ZX-81☐ Spectrum ☐

How long have you had it? Less than one month ☐

One to six months ☐ Six to 12 months ☐ Longer than 12 months ☐

How did you buy it? Mail order ☐ W H Smith ☐ Second-hand ☐

If you intend buying another model, which one?. . . . .

If not, do you use someone else's? yes/no Do you intend buying one? yes/no

Which one? ZX-80 ☐ ZX-81 ☐ Spectrum ☐

5 Do you use any other system? yes/no

Which one?. . . . .

6 Do you own any peripherals? State makes.

Cassette player ☐ . . . .

RAM pack ☐ . . . .

Printer ☐ . . . .

Keyboard ☐ . . . .

Motherboard ☐ . . . .

Any other hardware ☐ . . . .

How did you buy them? Mail order through *Sinclair User* ☐

Other mail order ☐ Microfairs ☐ W H Smith ☐

Other sources, give details. . . . .

. . . .

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None of the questions is difficult and all information will be treated in confidence.
Please tick the boxes or write your answer in the space provided.

7 Do you buy any software? yes/no

What types?..........

From where?..........

How much do you spend each month?..........

8 Do you have a special monitor or television? yes/no

9 For what do you use the Sinclair computer?..........

....

What other uses do you intend to make of it?..........

....

10 Are you a member of a computer club? yes/no

Is it at school or private?..........

11 How long have you read *Sinclair User*?..........

Where do you obtain it?..........

What do you like about it..........

....

....

What do you not like?..........

....

How could it be improved?..........

....

12 What other computer magazines do you read?

Personal Computer World ☐ *Computer and Video Games* ☐ *Your Computer* ☐ *Practical Computing* ☐

Microcomputer Printout ☐ *Windfall* ☐ *Educational Computing* ☐ *Microdecision* ☐

Which Micro? ☐ *ZX Computing* ☐ *Sinclair Programs* ☐ *Popular Computing Weekly* ☐

Computer Today ☐

Any other? State which..........

PROGRAM PRINTOUT

SNAP



```
  10 LET P=0
  20 LET Q=P
  30 LET A$=""
  40 FOR C=1 TO 50
  50 LET B$=A$
  60 LET A=INT (RND*3)
  70 IF A=0 THEN LET A$="CLUB   "
  80 IF A=1 THEN LET A$="BAR    "
  90 IF A=2 THEN LET A$="CHERRY"
 100 LET B=6
 110 IF INT (C/2)≠INT (C/2) THEN
LET B=18
 120 PRINT AT 10.0,B;A$
 130 FOR F=1 TO 30
 140 NEXT F
 150 IF A$<>B$ THEN GOTO 200
 160 LET C$=INKEY$
 170 IF C$="Q" THEN LET Q=Q+1
 180 IF C$="P" THEN LET P=P+1
 190 PRINT AT 0,3;"<";Q.">";AT 0
21;"<";P;"P"
 200 IF INKEY$<>"" THEN GOTO 200
 210 NEXT C
```

AS ITS NAME suggests, **Snap** is a version of the well-known card game but instead of cards the program has three words, 'club', 'bar' and 'cherry' which appear in random order on two sides of the screen.

When two words are the same, the two players have to press their keys, either Q or P, as quickly as possible, to score a point.

The game lasts for four attempts, and the score for each player is displayed at the top of the screen.

It is a simple game but can be fitted into 1K RAM and is one of the few games of this size which can be played by two players.

Snap was sent by Tim Crossley of York.

NUMBER CRUNCHER

NUMBER CRUNCHER is an interesting game which can fit on the basic 1K version of the ZX-81. It is another variation on the many slalom-type games.

As the name indicates, the 'obstacles' are made up of numbers of random value and position on a path. The aim is to make as high a score as possible.

The cursor moves automatically down the path and is shifted to the left using the 'Z' key and to the right by the 'M' key.

After a certain length of time the game stops and the score, plus a rating, is displayed.

It was sent by N Page of Kingston upon Thames, Surrey.

```
  5 LET A$="PEEK (PEEK 16398+25
6*PEEK 16399)"
 10 LET X=VAL "13"
 15 LET S=PI-PI
 50 FOR F=1 TO VAL "75"
 55 SCROLL
 60 PRINT AT 0,X;
 65 LET Q=VAL A$
 70 PRINT "▒"
 75 IF Q<VAL "29" OR Q>VAL "38"
THEN GOTO VAL "100"
 80 LET S=S+Q-VAL "28"
100■PRINT AT VAL "11",VAL "9";"
■SEVEN SPACES■";AT VAL "11",RND*
VAL "6"+VAL "10";INT (RND*VAL "9
")+VAL "1"
110 LET X=X+(INKEY$="M")-(INKEY
$="Z")
120 NEXT F
150 PRINT AT VAL "12",VAL "9";"
SCORE=";S
155 IF S<100 THEN LET S=100
160■PRINT TAB VAL "9";"RATING="
;INT ((S-VAL "100")/VAL "10")
```



GOLF

A NUMBER of attempts have been made to put the game of golf on to the ZX-81 and this one, sent by A Baines of Ashton-under-Lyne, Lancashire, is a simple version played on 16K of RAM memory.

When the program is run, a 'hole' appears at the bottom of the screen and the player is asked to supply the angle of shot, between 0 and 90 degrees, and the strength, a figure usually greater than 300. The trajectory of the shot is shown on the screen and the result.

Only one shot is allowed each time, which makes it necessary to remember angles and strengths from previous shots.

```
  5 REM "GOLF"
 10 LET T=15*(1+RND)
 20 PRINT AT 21,0;
 30 FOR J=0 TO 31
 40 PRINT "▒";
 50 NEXT J
 60 PRINT AT 21,T;" "
 70 PRINT AT 2,0;"SWING=";
 80 INPUT SWING
 90 PRINT SWING
100 PRINT "DRIVE=";
110 INPUT DRIVE
120 PRINT DRIVE
130 LET A=DRIVE*COS (PI*SWING/1
80)
140 LET B=DRIVE*SIN (PI*SWING/1
80)
150 FOR J=0 TO B/16
160 LET C=.01*(B*J-16*J*J)
170 IF A*J>6200 THEN GOTO 220
180 IF C>40 THEN GOTO 200
190 PLOT .01*A*J,C+2
200■NEXT J
210 IF ABS (A*B/3200-T)<3 THEN
GOTO 240
220 PRINT AT 10,20;"MISSED"
230 STOP
240 FOR J=0 TO 1
250 PRINT AT 20-J,T;"HOLE IN 1"
260 NEXT J
```

```
5 LET S=PI-PI
7 LET Z=PI-PI
10 LET A=PI-PI
20 LET B=PI-PI
30 LET M=PI-PI
40 LET N=31
43 LET X=21
44 LET Y=PI-PI
50 LET P=INT (RND*21)
60 LET Q=INT (RND*31)
65 LET R=P+PI/PI
70 PRINT AT A,B;"+"
72 PRINT AT P,Q;"GRAPHIC SHIFT
ED H"
74 PRINT AT R,Q;"GRAPHIC SHIFT
ED H"
80 PRINT AT M,N;"GRAPHIC SHIFT
ED P"
90 PRINT AT X,Y;"GRAPHIC SHIFT
ED P"
95 LET S=S+PI/PI
100 LET A$=INKEY$
110 IF A$="8" THEN LET B=31
120 IF A$="5" THEN LET B=PI-PI
130 IF A$="6" THEN LET A=21
140 IF A$="7" THEN LET A=PI-PI
150 LET M=M+(M<A)-(M>A)
160 LET N=N+(N<B)-(N>B)
170 LET X=X+(X<A)-(X>A)
180 LET Y=Y+(Y<B)-(Y>B)
190 IF P=M AND Q=N OR P=X AND Q
=Y OR R=M AND Q=N OR R=X AND Q=Y
THEN GOTO VAL "300"
195 IF A=M AND B=N OR A=X AND B
=Y THEN STOP
200 CLS
210 GOTO VAL "70"
300 LET Z=Z+PI/PI
310 PRINT ;"HIT"
315 PAUSE 50
320 IF Z=2 THEN GOTO VAL "70"
330 PRINT ;"DEAD IN:";S
```

BUG BAITER is not a took-kit for attracting bugs in programs to emerge with their hands up but a game in which the aim is to tempt bugs to fall into a swamp.

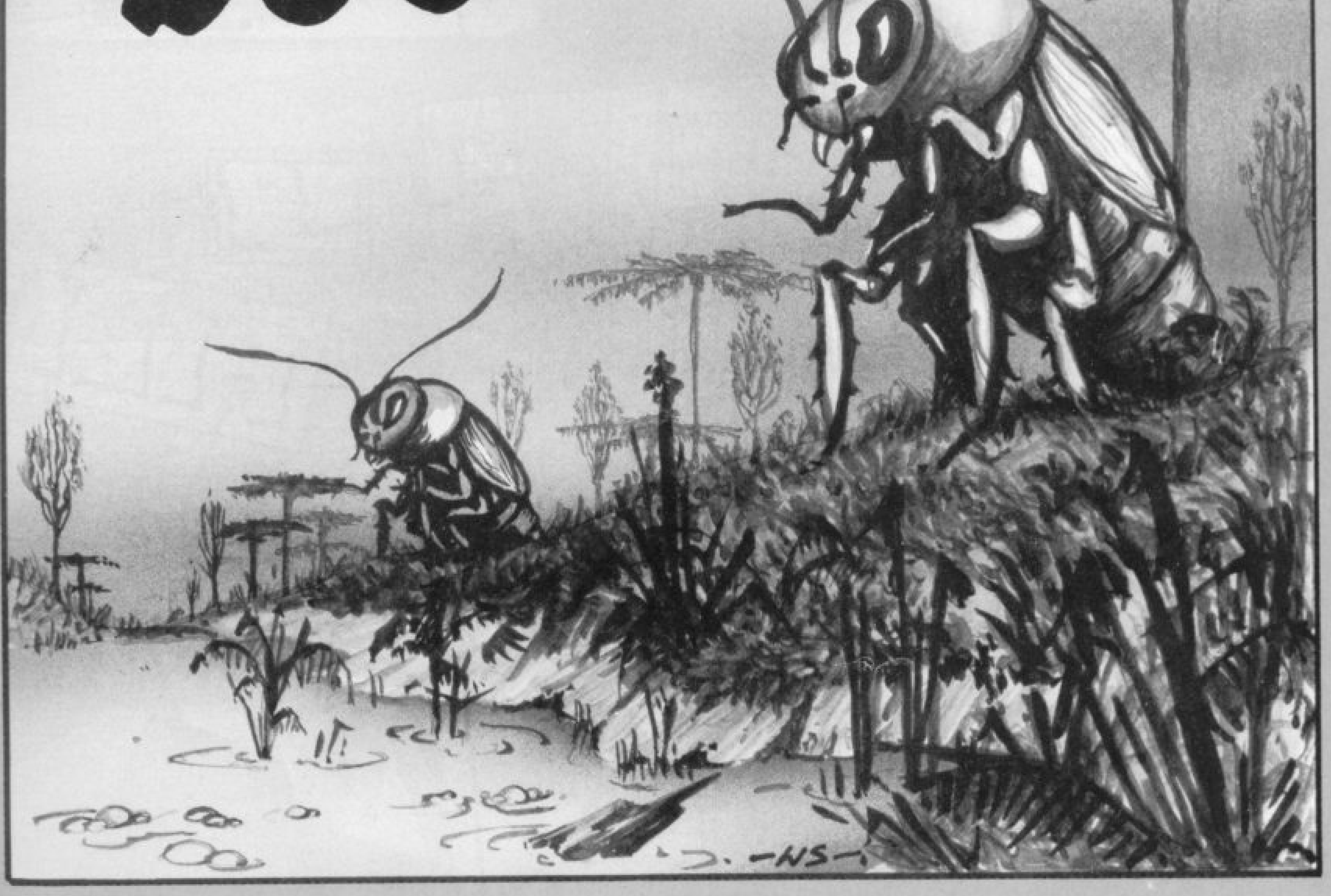
To start the game, press RUN, and the swamp is shown in one part of the screen with two bugs at random positions and a plus sign in one corner. The plus sign is the bait towards which the bugs move.

The game involves moving the plus sign from corner to corner, using the cursor keys above 5 to 8 so that the bugs fall into the swamp. Once one of the bugs falls in, the game stops and the length of time taken is shown.

If you wish to continue with the same lay out, press the CONT key. If you want a new game, press RUN.

The game was sent by M Archer and D Hayes of Godalming, Surrey.

BUG BAITER



FILING

THE NUMBER of entries for our May competition proved that as many people are using their ZX-81s for serious uses as for games. The variety of applications was wide and all were of a very high standard.

That made the task of the judges difficult once more but the eventual winner was John Fletcher, of Humberstone, Leicester, who submitted a system which files and retrieves information. He uses it to help keep track of 1,000 photographic slides, with each slide being described by six two-letter codes. It is possible to obtain lists of slides which have up to three codes in common.

Fletcher said he had bought the ZX-81 with the intention of producing such a system. He and his wife had so many slides, which are used to illustrate lectures, that it was difficult to sort them.

He was able to write the program, listed here, after having the machine for only three months.

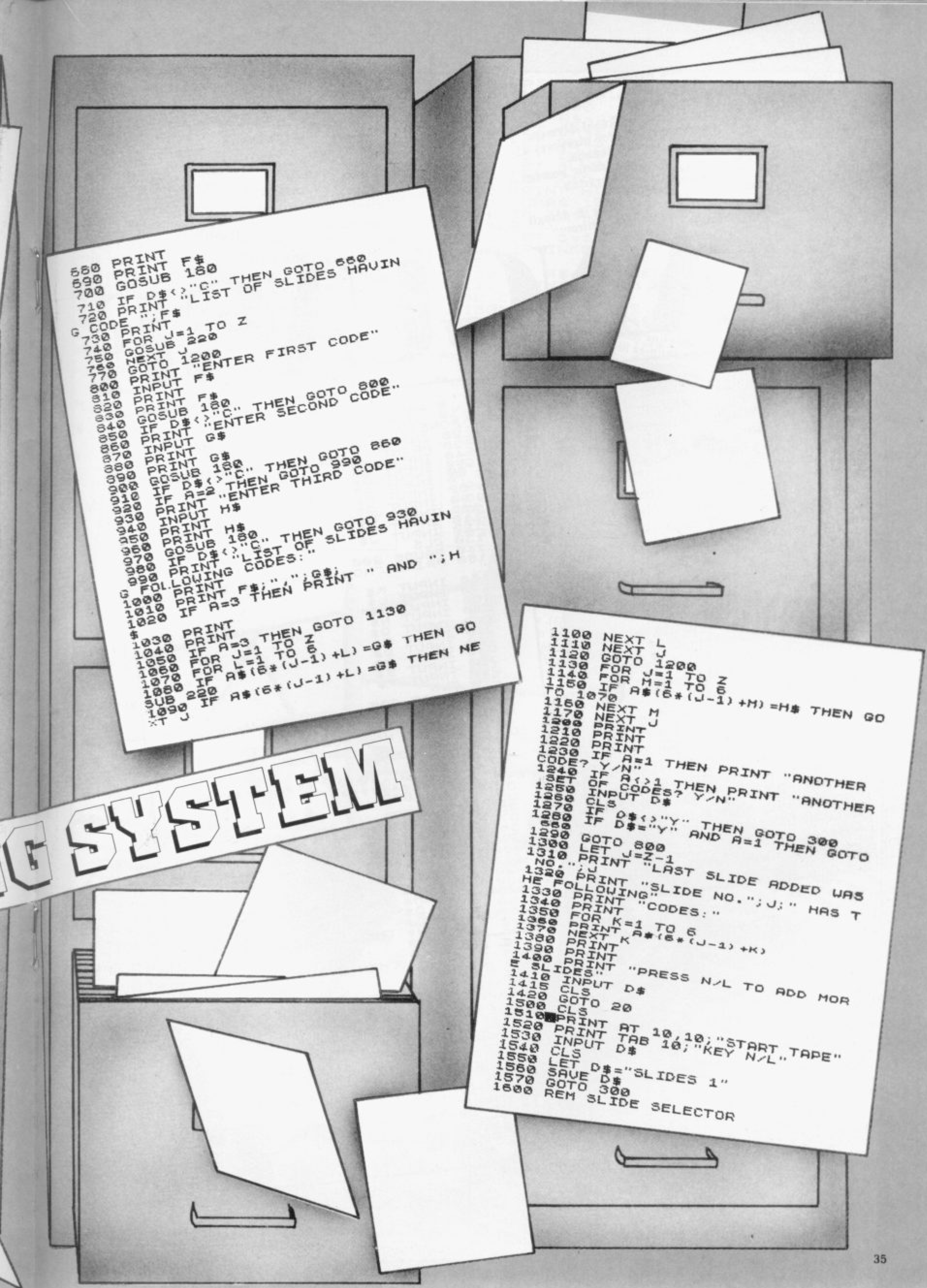
"I have always been interested in computers and learned how to use the ZX-81 very quickly," he said.

He added that LOADing and SAVEing time was five minutes but that was nothing compared to the time needed previously to sort through the slides.

The system is very general and can be used for other types of filing.

```
   3 REM SLIDE SELECTOR
   5 REM BY JOHN R. FLETCHER
   7 FAST
  10 DIM A$(6000,2)
  15 LET Z=1
  20 FOR J=Z TO 1000
  30 FOR K=1 TO 6
  40 PRINT "KEY IN CODES FOR SLI
DE NO.";J
  50 PRINT
  60 PRINT "CODE NO.";K
  80 INPUT A$(6*(J-1)+K)
  90 PRINT A$(6*(J-1)+K)
 100 GOSUB 180
 110 IF D$<>"C" THEN GOTO 40
 120 NEXT K
 130 PRINT "ARE THERE ANY MORE S
LIDES? Y/N"
 140 INPUT D$
 150 CLS
 160 IF D$="Y" THEN NEXT J
 165 LET Z=J+1
 170 GOTO 300
 180 PRINT AT 15,1;"KEY C IF THI
S IS OK, OTHERWISE NEWLINE"
 190 INPUT D$
 200 CLS
 210 RETURN
 220 FOR K=1 TO 6
 230 IF A$(6*(J-1)+K)=F$ THEN PR
INT J;",";
 240 IF A$(6*(J-1)+K)=F$ THEN NE
XT J
 250 NEXT K
 260 RETURN
 300 PRINT "
PROGRAM "      SLIDE EXTRACTION
 320 PRINT
 330 PRINT "FOR INDIVIDUAL SLIDE
S       KEY 0"
 340 PRINT
```

```
 350 PRINT "FOR 1-TERM SELECTION
        KEY 1"
 360 PRINT
 370 PRINT "FOR 2-TERM SELECTION
        KEY 2"
 380 PRINT
 390 PRINT "FOR 3-TERM SELECTION
        KEY 3"
 400 PRINT
 410 PRINT "FOR ADDING MORE SLID
ES      KEY 4"
 420 PRINT
 422 PRINT "FOR SAVING PROGRAM
        KEY 5"
 424 PRINT
 430 PRINT "FOR CHANGING PROGRAM
        KEY 9"
 440 INPUT A
 450 CLS
 460 IF A=0 THEN GOTO 500
 470 IF A=1 THEN GOTO 660
 480 IF A=4 THEN GOTO 1300
 485 IF A=5 THEN GOTO 1500
 490 IF A=9 THEN LIST
 495 GOTO 800
 500 PRINT "KEY IN SLIDE NO."
 510 INPUT J
 520 CLS
 530 PRINT "SLIDE NO.";J;" HAS T
HE FOLLOWING"
 540 PRINT "CODES:"
 550 PRINT
 560 FOR K=1 TO 6
 570 PRINT A$(6*(J-1)+K)
 580 NEXT K
 590 PRINT
 600 PRINT
 610 PRINT "ANOTHER SLIDE? Y/N"
 620 INPUT D$
 630 CLS
 640 IF D$="Y" THEN GOTO 500
 650 GOTO 300
 660 PRINT "ENTER CODE"
 670 INPUT F$
```




```
580 PRINT F$
590 PRINT 180
700 GOSUB 180
710 IF D$<>"C" THEN GOTO 660
720 PRINT "LIST OF SLIDES HAVIN
G CODE ";F$
730 PRINT
740 FOR J=1 TO Z
750 GOSUB 220
760 NEXT J
770 GOTO 1200
800 PRINT "ENTER FIRST CODE"
810 INPUT F$
820 PRINT
830 PRINT F$
840 GOSUB 180
850 IF D$<>"C" THEN GOTO 800
860 PRINT "ENTER SECOND CODE"
870 INPUT G$
880 PRINT
890 PRINT G$
900 GOSUB 180
910 IF D$<>"C" THEN GOTO 860
920 IF A=2 THEN GOTO 990
930 PRINT "ENTER THIRD CODE"
940 INPUT H$
950 PRINT
960 PRINT H$
970 GOSUB 180
980 IF D$<>"C" THEN GOTO 930
990 PRINT "LIST OF SLIDES HAVIN
G FOLLOWING CODES:"
1000 PRINT
1010 PRINT F$;",";G$;
1020 IF A=3 THEN PRINT " AND ";H
$
1030 PRINT
1040 PRINT
1050 IF A=3 THEN GOTO 1130
1060 FOR J=1 TO Z
1070 FOR L=1 TO 6
1080 IF A$(6*(J-1)+L)=G$ THEN GO
SUB 220
1090 IF A$(6*(J-1)+L)=G$ THEN NE
XT J
```

```
1100 NEXT L
1110 NEXT J
1120 GOTO 1200
1130 FOR J=1 TO Z
1140 FOR M=1 TO 6
1150 IF A$(6*(J-1)+M)=H$ THEN GO
TO 1070
1160 NEXT M
1170 NEXT J
1200 PRINT
1210 PRINT
1220 PRINT
1230 IF A=1 THEN PRINT "ANOTHER
CODE? Y/N"
1240 IF A<>1 THEN PRINT "ANOTHER
 SET OF CODES? Y/N"
1250 INPUT D$
1260 CLS
1270 IF D$<>"Y" THEN GOTO 300
1280 IF D$="Y" AND A=1 THEN GOTO
 660
1290 GOTO 800
1300 LET J=Z-1
1310 PRINT "LAST SLIDE ADDED WAS
 NO.";J
1320 PRINT "SLIDE NO.";J;" HAS T
HE FOLLOWING"
1330 PRINT "CODES:"
1340 PRINT
1350 FOR K=1 TO 6
1360 PRINT A$(6*(J-1)+K)
1370 NEXT K
1380 PRINT
1390 PRINT
1400 PRINT "PRESS N/L TO ADD MOR
E SLIDES"
1410 INPUT D$
1415 CLS
1420 GOTO 20
1500 CLS
1510 PRINT AT 10,10;"START TAPE"
1520 PRINT TAB 10;"KEY N/L"
1530 INPUT D$
1540 CLS
1550 LET D$="SLIDES 1"
1560 SAVE D$
1570 GOTO 300
1600 REM SLIDE SELECTOR
```

LANGUAGE

A SIMPLE learning program has been introduced by Andrew Wilson of Putney, London. He has called it **Language** and his version can be used to help vocabulary in foreign languages.

When the program is run, it asks for 10 foreign words to be typed-in, followed by their English translations. The foreign words then appear on the screen and the user is required to insert the English equivalents; the program comments on whether they are correct or not.

It is ideal for someone wishing to test themselves on a group of words they wish to learn, or for someone who wishes to set a test for someone else. No doubt with a little ingenuity it could be extended to cope with more words.

As it is for the user to decide which words are put in, the possible variations are endless. It is also possible to extend the system to involve other subjects, such as simple mathematics with a problem and answer being entered for someone else whose efforts can then be checked immediately by the program.

```
   5 REM "LANG"
  10 PRINT TAB (2);"PRINT IN YOU
R FOREIGN WORD"
  20 INPUT A$
  30 PRINT "  AND ANOTHER NINE."
  40 INPUT B$
  50 INPUT C$
  60 INPUT D$
  70 INPUT E$
  80 INPUT F$
  90 INPUT G$
 100 INPUT H$
 110 INPUT I$
 120 INPUT J$
 130 CLS
 140 PAUSE 200
 150 PRINT "NOW PRINT THE ENGLIS
H"
 160 INPUT K$
 170 INPUT L$
 180 INPUT M$
 190 INPUT N$
 200 INPUT O$
 210 INPUT P$
 220 INPUT Q$
 230 INPUT R$
 250 INPUT S$
 260 INPUT T$
 270 CLS
 280 PAUSE 200
 290 PRINT "NOW I,LL FIRE THESE
FOREIGN","WORDS AT YOU "
 300 PRINT "AND YOU GIVE THE ANS
WERS"
 305 PAUSE 300
 306 CLS
 310 PRINT AT 10,0;"***********G
ET READY*************"
 320 PAUSE 500
 330 CLS
 360 PRINT A$
 370 INPUT A$
 380 IF A$=K$ THEN GOSUB 1000
 390 PRINT B$
 400 INPUT B$
 410 IF B$=L$ THEN GOSUB 1000
 420 PRINT C$
 430 INPUT C$
 440 IF C$=M$ THEN GOSUB 1000
 450 PRINT D$
 460 INPUT D$
 470 IF D$=N$ THEN GOSUB 1000
 480 PRINT E$
 490 INPUT E$
 500 IF E$=O$ THEN GOSUB 1000
 510 PRINT F$
 520 INPUT F$
 530 IF F$=P$ THEN GOSUB 1000
 540 PRINT G$
 550 INPUT G$
 560 IF G$=Q$ THEN GOSUB 1000
 570 PRINT H$
 580 INPUT H$
 590 IF H$=R$ THEN GOSUB 1000
 600 PRINT I$
 610 INPUT I$
 620 IF I$=S$ THEN GOSUB 1000
 630 PRINT J$
 640 INPUT J$
 645 IF J$=T$ THEN GOSUB 1000
 650 STOP
1020 PRINT "CORRECT".
1030 RETURN
```

SHEEPDOG

FROM Daniel Shavick of Mill Hill, London, **Sheepdog** — a difficult game which is a good representation of a sheepdog trial.

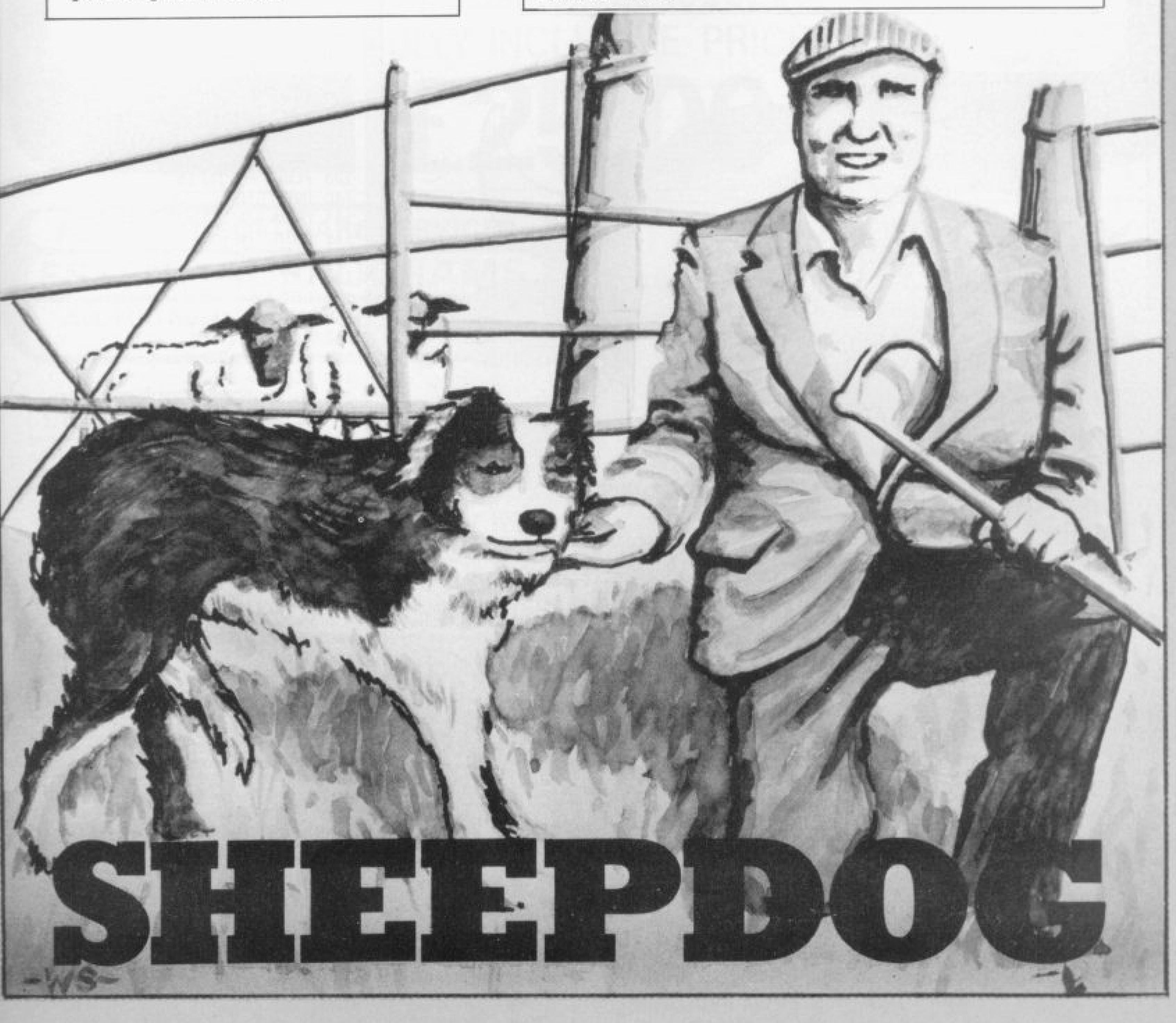
A sheep, an inverse S, is driven by a dog, an inverse D, through a gate, denoted by two black squares, and into a pen which is shown as a grey square. The dog is moved upwards by pressing the 'O' key, downwards by the '.' key, left by 1 and right by 3. It continues moving until the S is pressed.

When the dog is within five squares of the sheep, the sheep begins to move. The difficulty is that the movement of the sheep tends to be as wayward as any sheep in a real trial.

After a good deal of concentration, the sheep can be penned and the time taken is displayed. As a guide it took our reviewer 1,079 seconds — one second short of 18 minutes.

The game can be re-started by pressing NEW LINE.

```
  10 PRINT AT 19,29;CHR$ 136;AT
10,5;CHR$ 128;AT 10,11;CHR$ 128
  20 LET S=0
  30 LET A$=""
  40 LET DH=21
  50 LET DL=5
  60 LET SH=5
  70 LET SL=25
  80 LET Z=5
  90 PRINT AT SH,SL;CHR$ 184;AT
DH,DL;CHR$ 169
 100 IF SH=19 AND SL=29 THEN GOT
O 1000
 110 LET S=S+1
 120 IF INKEY$<>"" THEN LET A$=I
NKEY$
 130 IF A$="" THEN GOTO 90
 140 PRINT AT DH,DL;CHR$ 0;AT SH
,SL;CHR$ 0
 150 PRINT AT 19,29;CHR$ 136
 160 LET DH=DH+(A$=CHR$ 27 AND D
H<21)-(A$=CHR$ 52 AND DH>0)
 170 LET DL=DL+(A$=CHR$ 31 AND D
L<31)-(A$=CHR$ 29 AND DL>0)
 180 IF ABS (SH-DH)>=Z OR ABS (S
L-DL)>=Z THEN GOTO 90
 190 IF ABS (DL-SL)<Z THEN LET S
L=SL+(SL>DL)-(SL<DL)
 200 IF ABS (DH-SH)<Z THEN LET S
H=SH+(SH>DH)-(SH<DH)
 210 LET SH=SH+(SH<1)-(SH>20)
 220 LET SL=SL+(SL<1)-(SL>30)
 230 IF SH=10 AND (SL<6 OR SL>10
) THEN LET SH=SH-1
 240 GOTO 90
1000 PRINT AT 21,0;S;" SECONDS"
1010 PAUSE 4E4
1020 CLS
1030 RUN
```



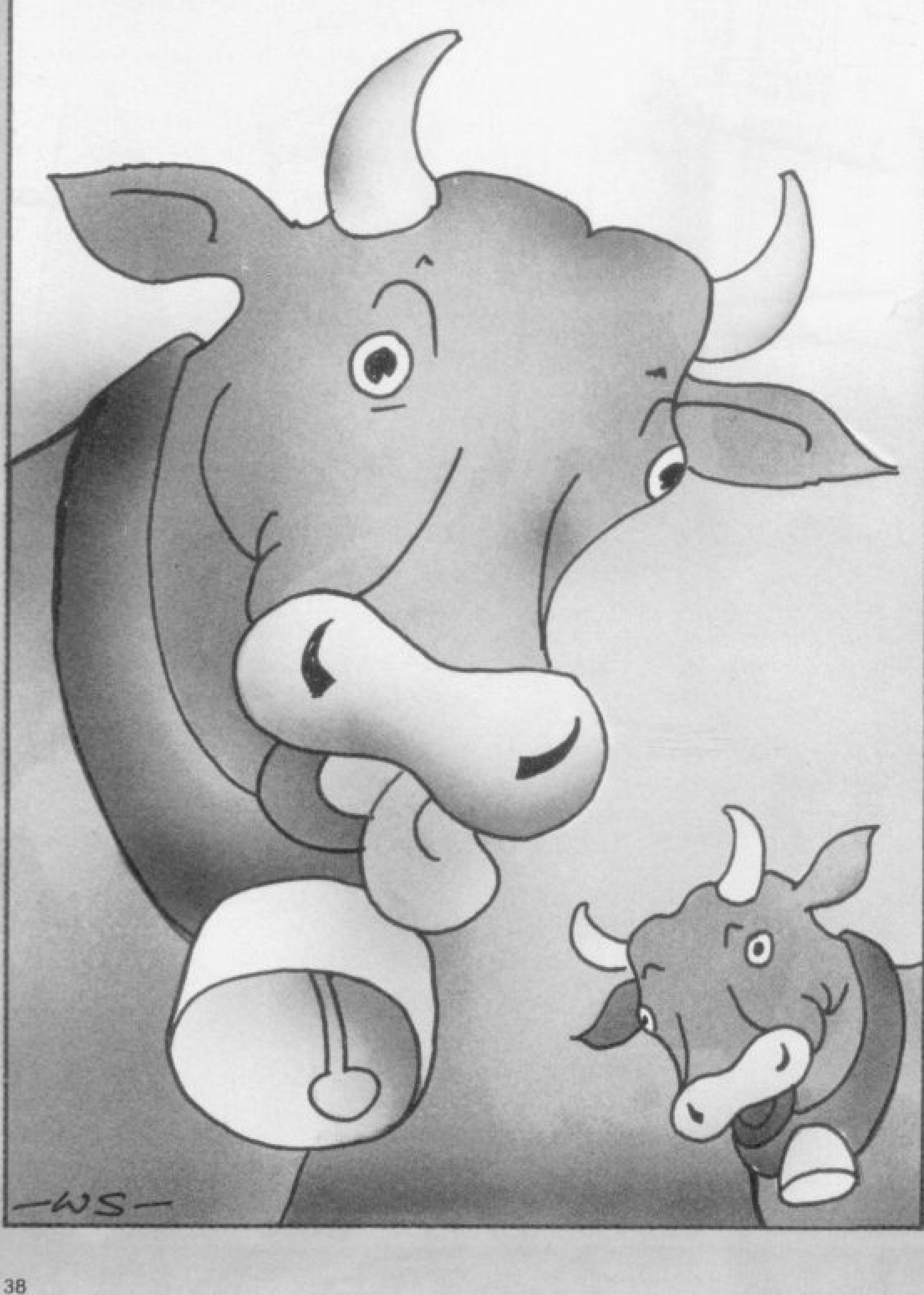
BULLS & COWS

WE INCLUDE a special program for users of the ZX-80. It is a version of the well-known game of **Mastermind**, where four numbers are picked at random by the program and the player has a limited number of attempts in which to guess the numbers.

To guide the player, the program marks each attempt by bulls and cows. A bull denotes a correct number in the proper position in the sequence and a cow means that the number is correct but in the wrong place.

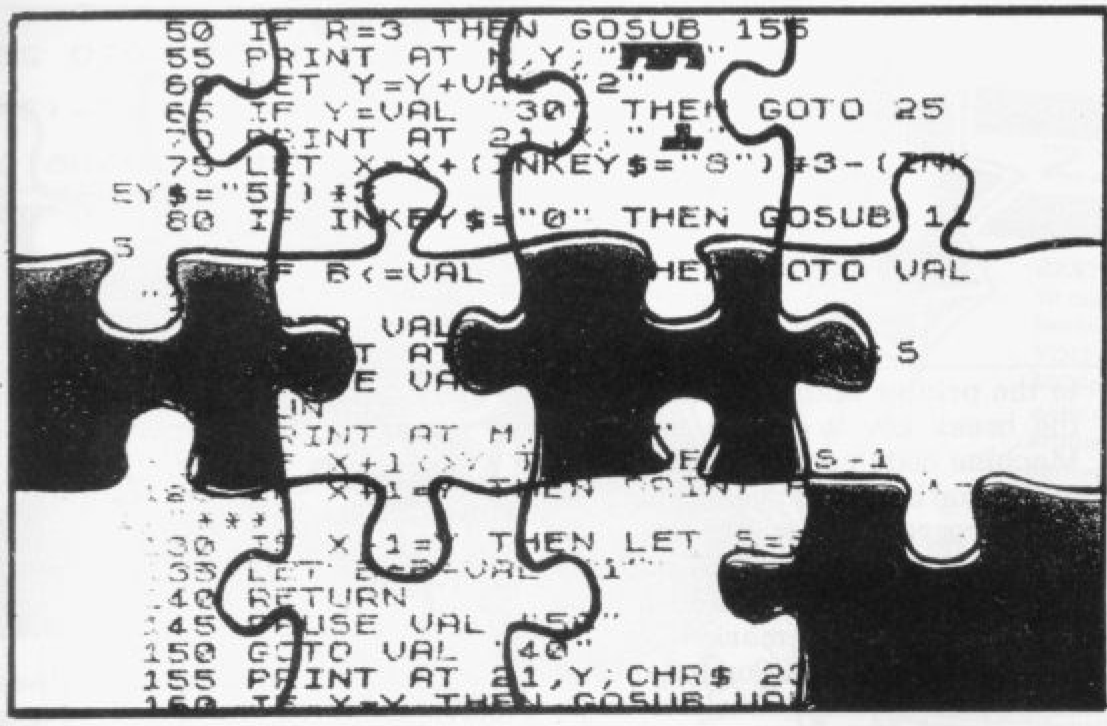
The game continues until the correct number is guessed or the player has had 15 attempts. Press RUN for another number to be guessed.

Bulls and Cows was sent by G Gill of Westerham, Kent.




```
 10 Dim N (4)
 20 FOR A = 1 TO 4
 30 LET N(A) = RND (9)
 40 NEXT A
 45 FOR A = 1 TO 4
 50 FOR C = 1 TO 4
 60 IF A = C THEN GOTO 100
 70 IF N(A) = N(C) THEN GOTO 20
100 NEXT C
110 NEXT A
120 LET A = N(1) *1000 + N(2)
    *100 + N(3) *10 + N(4)
130 PRINT "ENTER YOUR GUESS"
135 FOR F = 1 TO 15
140 INPUT B$
141 IF B$ = " " THEN GOTO 360
142 PRINT B$ ;" = ";
143 LET B = 0
144 LET C = 0
150 LET A$ = STRI$ (A)
160 LET X$ = A$
165 LET C$ = B$
180 FOR S = 1 TO 4
190 FOR D = 1 TO 4
200 IF CODE(X$) = CODE(C$) THEN
    GOSUB 400
210 LET C$ = TL$(C$)
220 NEXT D
225 LET C$ = B$
230 LET X$ = TL$(X$)
240 NEXT S
250 IF B = 4 THEN GOTO 350
260 PRINT B; "BULLS"; C; "COWS"
270 NEXT F
280 PRINT "I'LL TELL YOU THAT
    IT WAS"; A
350 PRINT "THAT'S IT"
360 STOP
400 IF S = D THEN LET B = B + 1
410 IF NOT S = D THEN LET C = C + 1
420 RETURN
```

• Because of the large number of programs which have been sent to us, we cannot acknowledge everything which we receive. If you have not heard from us within one month of despatch, it is unlikely that we will be using your submission.





The popularity of writing in machine code is growing. Phil Garrett looks at the systems which can help.

Aids for speed and efficiency

JUDGING by the popularity of **Space Invader**-type arcade games for the ZX-81, and of books such as Toni Baker's *Mastering machine code on your ZX-81*, it seems the ZX-81 owners want not only to run machine code programs but write them, too. That is scarcely surprising, considering the tremendous speed and efficiency of a machine code program compared to Basic, but there is a trade-off involved.

I wrote a three-dimensional **Noughts and Crosses** program for my ZX-80 which played a good game but had a response time of 45 seconds. A year later I wrote the same program in machine code on my ZX-81 and it had a response time of less than half a second. Writing that program, however, had taken eight complete days of my summer holiday.

Broadly speaking, there are three types of program available to aid the budding machine code adventurer. The most complex and probably most useful programs are the assemblers, which convert mnemonics into machine code; then there are disassemblers which do the reverse and, finally, monitor programs which allow close examination of a machine code program as it runs, plus other functions. When Zilog produced the Z-80 microprocessor, each of its hundreds of instructions was given a mnemonic so that users could remember what a particular instruction would do. For example, LD A, H means load the Accumulator with the contents of the H register and represents 124 in machine code. The mnemonic is entirely arbitrary and could just as well have been LOAD A FROM H.

We could produce a machine code program by POKEing instructions byte by byte into RAM and plenty of machine code loader programs do just that. The method, though, is highly error-prone and time-consuming if the program is substantial. On the other hand, an assembler program converts the mnemonic form of instructions — which we can understand reasonably easily — into machine code which the microprocessor can understand and execute.

In some ways the assembler program is similar to the Basic ROM in the ZX-81. The ROM scans the program for Basic keywords — LD, CALL — and then places the corresponding instruction in the RAM.

The ability to use labels makes an assembler very powerful, as it allows the programmer to refer to instruction lines, subroutines, and even data by means of symbols, rather than having to determine the addresses each time.

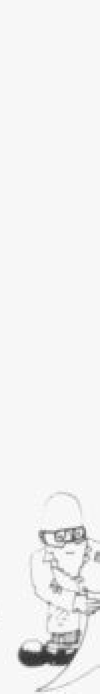
Sufficient of the theory; how are the ZX-81 assemblers used? Bug-Bytes ZXAS assembler is in 5K of machine code, with a few lines of Basic to operate it. The program resets RAMTOP automatically and loads itself above it, so that assembler source programs can be loaded and saved separately. Lines of mnemonics are entered in REM statements, with multiple instructions allowed, provided they are separated by semi-colons. Up to 256 labels can be used in the form :L0 to :L255, and comments may be placed after a "*". Full-stops are used instead of commas — e.g., LD A. H — which makes typing instructions easier and numbers may be entered in decimal or hex. When the assembler is run, you are prompted for the starting address for the resulting machine code. Invariably I use a REM statement at the start of the program, and compile the machine code from 16514. The assembler code is then displayed on the screen in the format source line number; address (in hex); opcode and data (in hex); Z-80 mnemonic. If there is an error, the assembler stops with an error code, so it is not difficult to build a syntactically-correct source program.

> 'There is a trade-off between the speed of the final program and the time taken to write it.'

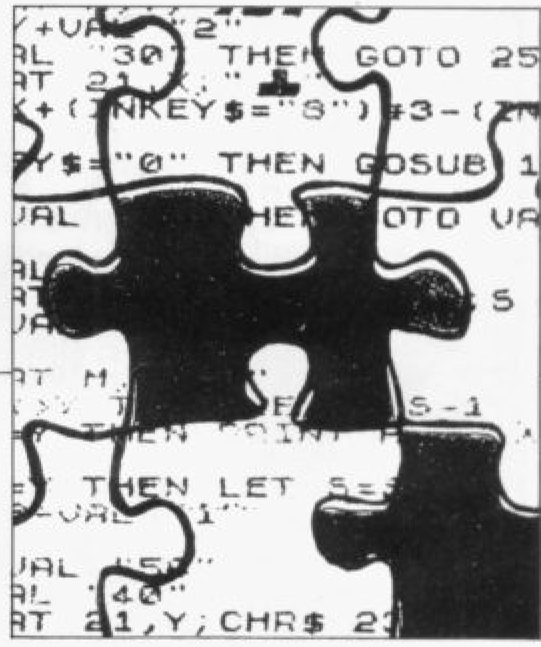
There is at least one bug in ZXAS; the SUB A,n instruction does not work but it can be replaced by AND A; SBC A,n which does the same. ZXAS is a remarkable program and is excellent value at £5.

The only other ZX-81 assembler I have encountered is produced by

continued on page 42







continued from page 41

ACS Software. It is similar to ZXAS in size and operation, with instructions entered in REM statements and labels available in the form Q.1: Q.255:.

Data must be entered in decimal rather than hex — I prefer decimal — and there is a useful DFB function which allows you to specify the contents of a particular byte during assembly, so you can have messages embedded in your machine code.

The assembled listing display is slightly different from ZXAS; you are given the decimal address, hex opcode and data, and then the mnemonic.

The ACS assembler is also excellent value at £5.50 and the use of either this program or ZXAS is the single biggest step to proficiency in machine code programming.

Neither program sets out to teach assembler, so a book will also be needed. I use the thorough but expensive *Programming the Z-80* by Rodney Zaks but there are now several books available specifically for machine code programming on the ZX-81.

Disassemblers convert machine code into mnemonics, making it easier to analyse and amend. The ACS disassembler can be used at the same time as its assembler and provides mnemonic listings in the same format. All addresses are shown in decimal and destination addresses are shown for relative jumps rather than the displacement, which is an excellent idea.

All the other disassemblers have additional bells and whistles to assist with editing and debugging machine code. Campbell Systems 4K disassembler uses plenty of Basic and its machine code occupies my favourite 16514 onwards area of RAM. It has a handy facility to step backwards and displays contents in hex, with addresses and mnemonics in decimal. You cannot dump direct to the printer and you have to use the break key to return to Basic. Machine code can be entered, and individual bytes changed, using hex. This program, price £4, has been available since June, 1981 and has perhaps been superceded by some of the others on the market.

The Aylesbury ZX Computer Club has decided courageously to enter the software fray with its disassembler. It is a very large program (14K) and runs a little slower than the others. The display, which can go to screen, printer, or both, is unusual; addresses, contents and mnemonic data are given in both hex and decimal and the display allows one line for each byte. There is also a facility to enter machine code from address 30000 in either hex or decimal and an Edit function to alter a byte or copy a block of bytes from one area of RAM to another. It is good value at £3.50 plus 50 pence for postage and packing.

Bug-Bytes **ZXDB** disassembler can be used in conjunction with its ZXAS assembler and occupies 4K from address 16514. It works entirely in hex and does not dump to the printer, although you can circumvent that by disassembling 12 lines or so, then calling 0869H, which is the Sinclair ROM COPY subroutine.

'In some ways the assembler program is similar to the Basic ROM in the ZX-81.'

Another disadvantage is that some of the mnemonics belong to the 8080 rather than the Z-80, e.g., LD A, (HL) appears as LD A,M. It has a very large number of sophisticated monitor functions, so I have included it among the monitors as well. ZXDB costs £6.50.

MicroGen **Debug** is also a disassembler with some monitor functions, works entirely in hex, and can be used with a printer. Care has to be taken when transferring from Basic to Debug and back, or the ZX-81 will crash. I found the monitor display impressive, although more detailed instructions would have been helpful. The program lives above RAMTOP, which it re-sets automatically, and costs £3.95.

ACS-Debug can be used in conjunction with the ACS assembler and disassembler to provide a complete, if rather expensive, machine code writing package. It stores above RAMTOP, uses decimal numbers only, and does not dump to the printer. Once again, it costs £5.50.

The Picturesque **ZX-MC** is another sophisticated monitor; it is rather like a separate operating system. You cannot use it with any existing machine code programs, as it uses low memory and has its own stack in high memory. It has its own loading and saving routines which operate at twice the speed of the ZX-81. The program is complete with a comprehensive manual for £7.50 but I believe its incompatibility with other programs is a serious disadvantage.

The Taurus **Machine Code Monitor** is placed above RAMTOP and is available as a cassette and also in EPROM form as part of its 16K RAM pack system. With the latter you can switch from 14K RAM plus 2K monitor to the full 16K RAM. Apart from the usual functions, it has a helpful hex calculator and a facility to create REM statements of any length. It also has a comprehensive manual at £7.50 in cassette form, and the RAM-pack system costs £48.

Bug-Byte, 98-100 The Albany, Old Hall Street, Liverpool L3 9EP.

ACS, 7 Lidgett Crescent, Roundhay, Leeds LS8 1HN.

Campbell Systems, 15 Rous Road, Buckhurst Hill, Essex IG9 6BL.

Aylesbury ZX Computer Club, 12 Long Plough, Aston Clinton, Aylesbury, Bucks.

MicroGen, 24 Agar Crescent, Bracknell, Berkshire.

Picturesque, 6 Corkscrew Hill, West Wickham, Kent BR4 9BB.

Taurus, 47 High Street, Baldock, Herts SG7 6BG.



Accounting for small business

TWO sophisticated accounting programs have been put on to the market by Hestacrest with the intention of improving the efficiency of routine accounting at low cost.

The programs are written for preparing accounts from incomplete records of a sole trader and a limited company. They are written for use mainly by accountants but they can also be useful to the small trader with a little knowledge of accounting.

Figures can be entered into the accounts in the usual forms, including cash payments and receipts and bank payments and receipts. Using a system of coding, the accounts are then built-up from those, printing-out all the records of interest to the company.

The programs are available from Hestacrest, PO Box 19, Leighton Buzzard, Bedfordshire. LU7 0DG, costing £17.50 each or £25 for the two.

Improved Othello

MINE of Information has produced what it claims to be an improved version of its game **Othello.** The improvements include more features for a lower total price of £6.90, better loading and easier use.

All input is said to be crashproof and loading problems have been overcome by a hardware modification to generate a strong, clean, original signal and tape duplication using a signal enhancement process.

The new features include the ability to replay moves at any stage, both forward and backward.

The new program, known as version 3.5, was shown at the ZX Microfair at the beginning of April and lost only one contest out of 30 when playing at half power.

Othello is available from Mine of Information, 1 Francis Avenue, St Albans, Hertfordshire.

Adventures from Algor

ALGOR has produced two adventure games which are different from anything else on the market. **Shelob's Lair** is a 13K Basic and machine code game which gives a 3D image of your location and shows all the exits in perspective.

There are plenty of monsters and treasures, represented in words rather than graphics, scattered around the 180 rooms.

The room displays are generated using code and are impressively fast. The layout and the contents of the rooms change only if you reach a different level, in which case a set of tougher monsters and more valuable treasures is generated.

The other program is **Mines and Monsters,** which allows up to four players to play at the same time. It is a 13K Basic game in which all the locations, treasures and monsters are generated randomly at each turn.

It is not very exciting but is entertaining enough and useful, if only to avoid family arguments about who can use the ZX-81.

Both programs cost £3.50, Shelob's Lair being packaged with an economy simulation game and Mines and Monsters having a multi-player stock market game. Algor is at Dovercourt, St. James Road, Northampton.

Zuckman for the ZX-81

WHAT IS said to be the first ZX-81 version of the popular arcade game **Puckman** has been produced by DJL Software. Called **Zuckman,** it runs on the ZX-81 with the 16K RAM pack.

It is very user-friendly, giving complete instructions for playing. Written in machine code, it is a fast and interesting game and requires a quick appreciation of how to move the figure.

Zuckman is available from DJL Software, 9 Tweed Close, Swindon, Wiltshire.

Parlez-vous le Basic?

A CASSETTE to help children with GCE O level French examinations has been produced by Rose Cassettes, which specialises in educational software for the ZX-81. For use with the 16K RAM pack, it covers grammar



and vocabulary. On the first side, there are three sections dealing with verbs, pronouns and adjectives, with lessons followed by tests. The second side deals with vocabulary, with 345 nouns, more than 190 verbs and about 290 common expressions.

The cassette is available from Rose Cassettes, 148 Widney Lane, Solihull, West Midlands at a cost of £4.50 including postage.

Fighting the Prince aliens

FOR THE intrepid fighter against all things alien, **Astro-Invaders** is the lead game in a pack available from John Prince Software costing £3.65.

According to the company there is no superior version of the game on the market at such a competitive price. In machine code, it runs automatically on loading and involves 54 manoeuvring aliens which are knocked out by photon-firing torpedoes. As the game proceeds the attack rate increases.

The other games in the pack are **Grand-Prix, Penalty, Golf** and **Swat.**

John Prince Software is at 29 Brook Avenue, Levenshulme, Manchester.



Kempston keyboard

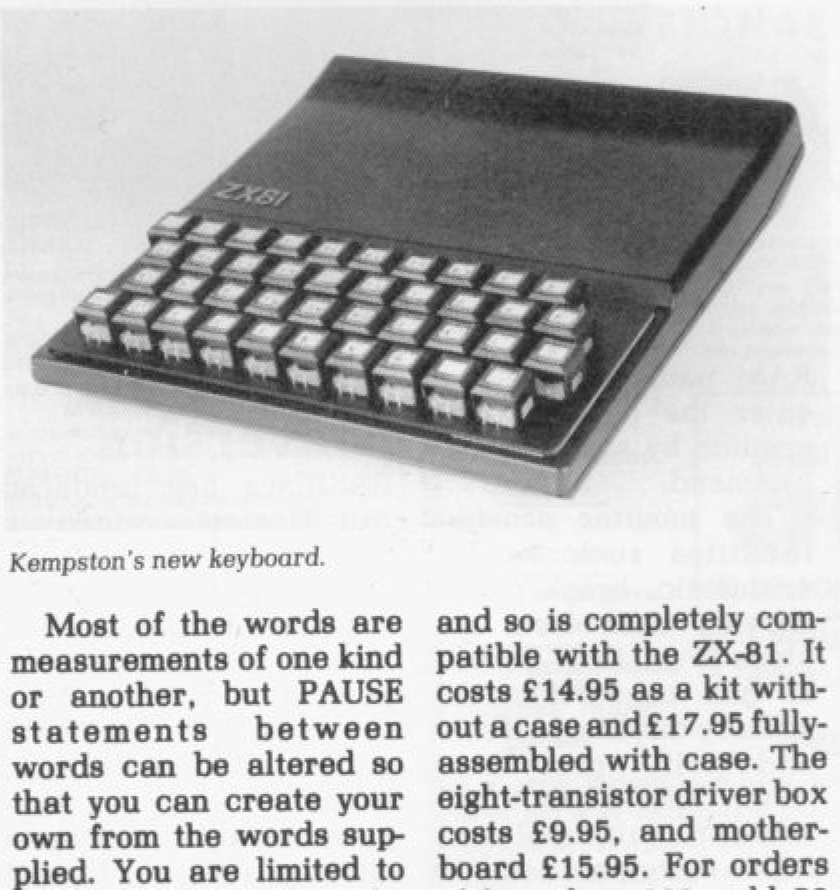
KEMPSTON Electronics has produced a micro-miniature version of the ZX-81 keyboard with real keys. It is the same size as the original Sinclair keyboard and so can be placed on the top of it. It is only half-an-inch high and its black keys blend well with the ZX-81.

The keyboard can be fitted by opening the case and removing the original leads to the sockets on the PCB and replacing it with the leads from the Kempston unit.

The company also produces an Educase which exposes the printed circuit board to the naked eye, for students and teachers to see through the clear plastic cover.

It is ideal for demonstrating the working of a computer; the back can contain a parallel port complete with a demonstration program to run a Centronics printer. Unfortunately there are no Sinclair graphics. The keyboard costs £22.50, Educase £19.95, and the parallel port £18.95.

Kempston Electronics is at 60 Adamson Court, Hillgrounds Road, Kempston, Bedford MK42 8QZ.



Kempston's new keyboard.

Speech pack from DCP

DCP has produced a speech pack which can be fitted directly to the back of a ZX-81 and which will not interfere with any planned expansion. Using a maximum of two memory-mapped ports at 49148 and 49149, the various ROMs containing the words can be POKEd via Basic to the loudspeaker included inside the unit.

The speech can be heard through the loudspeaker or, if required, can be amplified via the jack socket provided — 8 ohms. The amount of words it can say depends on the number of ROMs fitted inside the box. A maximum of four can be fitted and the basic model is supplied with the first one.

Most of the words are measurements of one kind or another, but PAUSE statements between words can be altered so that you can create your own from the words supplied. You are limited to the beginning of words, however, as the speech is stored only in complete words, not sounds.

The speech pack costs £49.95, complete with ROM 1, and extra ROMs are available at £14.95 each, including VAT and postage. DCP Microdevelopments, 2 Station Close, Lingwood, Norwich NR13 4AX.

Thurnell motherboard

THURNELL ELECTRONICS has now extended its range of equipment for the ZX-81 to include a motherboard, LED indicator board, transistor driver board, relay board to control up to 1.5A AC or 24V DC at 3A. All are in cases but the original I/O port is still available in kit form and without a case.

A motherboard can connect up to four devices to the port at once. The port is based on a Z-80A PIO and so is completely compatible with the ZX-81. It costs £14.95 as a kit without a case and £17.95 fully-assembled with case. The eight-transistor driver box costs £9.95, and motherboard £15.95. For orders of less than £20, add 50 pence for post.

Thurnell Electronics is at 95 Liverpool Road, Cadishead, Manchester M30 5BG. Tel: 061-775 4461.

Printer interface

CAPITAL COMPUTERS has produced the first motherboard with bank-switching incorporated on-board. The expansion motherboard also sorts out the reflections of the ROM and RAM so that the full 56K left can be used. It includes a + 5V regulator for a separate power supply, an optional metal case, and a range of plug-in boards.

The boards contain 16K of extra memory, full RS232 serial interface to drive printers, Centronics parallel interface for printers complete with handshaking, and a 2716 ROM containing the driver routines.

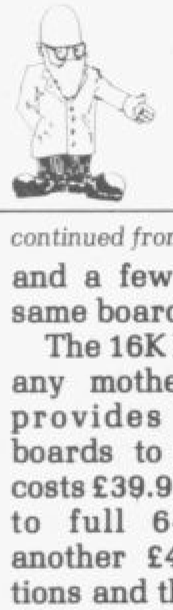
All the expansion motherboard sockets are buffered so that the pulling-out of cards should not crash the system. The expansion motherboard costs £40.20, serial/parallel interface board £45.95, 16K RAM £33.93, and the metal chassis £19.50.

All are obtainable from Capital Computers Ltd, 1 Branch Road, Park Street, St. Albans AL1 4RJ.

Memory board from Fuller

FULLER Micro Systems has added a new board to its range of equipment whch can fit inside its keyboard case. It starts as an ordinary 16K board supplied with the industrial standard 4116 chips but if you decide later that you need more memory you can upgrade the board to a full 64K by changing the RAM chips

continued on page 48



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and a few straps on the same board.

The 16K PCB will fit into any motherboard which provides sockets for boards to plug into and costs £39.95. To upgrade it to full 64K will cost another £45 for instructions and the 64K chips to fit to the board.

The complete Fuller Micro Systems range can be seen and purchased from The ZX Computing Centre, Sweeting Street, Liverpool 2.

TV Services bleeper

TV SERVICES of Cambridge has a neat little keyboard bleeper called the KAT keyboard audio tone. The device can be fitted inside the case in the space beneath the keyboard, or in any other place for that matter, as it is an extremely flat PCB and piezo-electric loudspeaker.

There are only five soldering connections to make to the ZX-81 PCB, as the rest is ready-assembled. If that makes you nervous, the company will fit it to your ZX-81.

The bleeper gives two tones, one when a key is pressed and one when the computer answers; it also signals the start and finish of a LOADing or SAVEing program. It may also be programmed to bleep in a program — for simulating an explosion — by using a PAUSE greater than 5.

The KAT costs £8.95 if you fit it yourself and £10.95 if you send your ZX-81 for it to be fitted.

TV Services of Cambridge Ltd, Chesterton Mill, Frenches Road, Cambridge CB4 3NP.

2K monitor EPROM

TAURUS Computer Design has a 16K RAM pack which also contains a 2K monitor EPROM for writing machine code programs on the ZX-81. It replaces the top 2K of RAM when the switch is thrown on the front of the RAM pack and you can enter the machine code monitor by a simple USR command.



The 16K RAM pack from Taurus Computer Design.

The monitor provides facilities such as hex arithmetic, break points, copying data from one place to another, decimal to hex conversion, fill, memory display, port read and write, plus many more. The monitor will write a suitable-length REM statement at the beginning of a program, so that your machine code routine can be stored there and will even re-set the Basic variables so that a RETURN from the monitor will not crash the program. All is contained in a metal box 6½ × 2½ × 1½in. which attaches to the ZX-81 edge connector via a ribbon cable to prevent crashing the program, due to the movement of the ZX-81.

The 16K RAM pack costs £59.95 with the monitor and £49.95 without, from Taurus Computer Design, 47 High Street, Baldock Herts SG7 6BG. Tel: 0462-893900.

BASICare conversion

BASICare has produced the Organic micro, a system which makes incompatability between systems out-of-date. The idea is that every computer should use the same connections to the RAM packs and ports but, because each time a computer manufacturer produces a new machine it changes the way it connects, that has not been possible previously.

Now BASICare will provide a personality module to convert the ZX-81, BBC computer or Apple in one standard connection, so that any computer can grow from 16K RAM to more than 1MB of RAM.

The packs which use the bus will then be available to be used by any machine to provide printers, ports, Toolkit programs, CMOS and dynamic modules.

The silver packs are connected mechanically as well as electrically, to each other, so there should be no chance of a faulty connection. The basic Persona module costs £30.42 inc. VAT and postage.

BASICare Microsystem Ltd, 5 Dryden Court, London SE11 4NH. Tel: 01-735 6408.

Metrimpex disc drive

METRIMPEX of Hungary is introducing a revolutionary new disc drive system to this country and at least one manufacturer, Macronics, has opted for it. The disc drive is very similar to an eight-track tape recorder, as the disc is stored in a hard plastic box which is opened only when the disc is inserted into the drive.

It can fit in the palm of your hand and can provide up to 200KB of memory on one disc. The power supply is + 12V and + 5V and it weighs only 0.47 kilogrammes.

The drive provides a standard interface so that it can be used with disc controllers already available. The price in quantity is £50 and details can be obtained from BATS-NCI Ltd, 375b Regents Park Road, London N3 1DG. Tel: 01-349 4511.

THE EXPLORER'S GUIDE To The ZX81

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Load the program in the normal way — enter, amend or delete your transactions (ZX81 will automatically scan standing order file and post any items due) — save the file of data onto cassette in 45 seconds — load a different datafile into the same program, also in 45 seconds — enter items, etc. — save datafile only onto cassette (45 seconds) — repeat operation for any number of accounts.

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- Automatic generation of standing orders on due dates.
- Validation of all entries.
- Correct any item previously entered. (Single/Multiple field correction.)
- Enter an item (previously omitted) in the correct date order of the account.
- Single key operation. Utilises a M/C keyboard scan.
- Search for any item or items by cheque number, description or amount — display (and printout if required) with totals.
- Continuous display of statement extract, continually updated during input of entry.
- File of standing order details can be displayed, printed, added to,. cancelled and amended.
- Detailed User Manual.
- After sales maintenance.

Send £9.95 ($20) incl. for cassette and users manual to J.P. Gibbons A.I.B., 14 Avalon Road, Orpington, Kent BR6 9AX, England. (Send large S.A.E. for details.)

There are only two suppliers of supported ZX81 software, this is one of them. Be sure to include your name and address.

Coming soon: Bank Reconciliation Module — a separate program on cassette that utilises data supplied by the main program (S.A.E. for full details).

The only expandable system for the ZX81

The Personal Banking System is also available from the Buffer Shop, Streatham, London and Branches of the Computer Bookshop Group, full maintenance still available.



Two of the leading figures in the development of the Spectrum, Richard Altwasser and Steven Vickers, have cut their links with Sinclair and set up their own company

Secret plans laid by new company

TWO OF the leading figures in the development of the ZX Spectrum have cut their links with Sinclair Research to set up their own company.

Richard Altwasser, who designed the hardware, and Steven Vickers, who wrote the programs for the ROM working memory, have formed Rainbow Computing Co. Apart from publishing a book of programs for the Spectrum, the company plans are a closely -guarded secret.

"It is necessary for us to be very cagey and apart from the one thing which we have announced, we would like to leave anything we are doing secret until it is ready for launching," says Altwasser. He adds, however, that something will be announced before the end of the year.

They decided to make the move now because their major project for the last nine months, the Spectrum, had ended and, like many other people, they wanted to be their own bosses.

"We had plenty of freedom working at Sinclair but at the end of the day the company was run by one man and if a decision needed to be made, there was one man who took that decision," Altwasser says.

He and Vickers add, jokingly, that they had also been tempted by the money Clive Sinclair was making.

Altwasser 25, gained a degree in engineering at Trinity College, Cambridge and went to work for a micro-based automation company in Worcester but found the organisation too limiting. After 18 months he left and joined Sinclair Research in September, 1980.

He did some work on the development of the ZX-81 and after its launch in 1981 he was made responsible for computer research, which involved him in the design of the hardware of the Spectrum.

Altwasser has also been writing software for the ZX-81 and his 'Cambridge Collection' has sold 30,000 copies.

Before joining Sinclair he had a little knowledge of computing, owning a TRS-80 and having run a course in teaching Basic.

Vickers' knowledge, however, was much less. "Two years ago I did not even know what a ROM was," he says.

Vickers, 29, was also at Cambridge, gaining a degree in mathematics at King's College before doing his PhD at Leeds. In 1980, after writing to a number of computer companies, including Sinclair, for a job, he joined Nine Tiles, a software consultancy based near Cambridge, which had written the ROM working memory for the ZX-81.

His first job was the adaptation of 4K ZX-80 ROM to make an 8K ROM for the ZX-81. He also wrote the manual for the ZX-81 and went on to write most of the ROM for the Spectrum, as well as assisting with the manual.

Both say that they found working for Sinclair very exciting — "providing you can cope with the pressure without having a heart attack." The main difference they found between Sinclair Research and other companies in electronics was that "deadlines were very real deadlines". Vickers says:

"There is a definition of a deadline; that it is the date before which something should not be completed but that is not the case with Sinclair."

Development of the Spectrum was typical of the way in which Sinclair Research works. A rough specification was worked-out with the main requirements, including colour, high-resolution graphics and improved tape storage interface.

That was set last September with a final deadline of the Earl's Court Computer Show in April. By that time the Spectrum had to be ready to go into production, which meant that not only had all the development work to be done at Sinclair Research but also all the suppliers had to be chosen and the production lines at Timex had to be tooled-up.

That had to be done in conditions of great secrecy and very little infor-

'We had plenty of freedom working at Sinclair but at the end of the day if a decision needed to be made there was one man who took that decision'



Steven Vickers (left) and Richard Altwasser (right) in front of Trinity College, Cambridge.

mation leaked-out about the machine, although Altwasser says he was surprised by how much was known about it before the launch.

In the end, with many nights of working late, the deadline was met and the Spectrum launched on time.

Other benefits of working for Sinclair were that there was no shortage of money for research and, as it was a small company, it was easy to obtain quick decisions on new ideas and new ways of doing things.

"When I went for interview I asked about money being available if a piece of equipment was needed and was told that a request was never refused, but that they might advise about something which would be better," say Altwasser.

For the future, Vickers and Altwasser say they are concerned to prevent a Japanese invasion of the British market. Their plans for doing that, however, are to remain secret.

Asked if their name denoted any link with the Spectrum, Altwasser replies that the only connection was that it has been one of the suggestions for the new machine which they had liked, so had decided to use it.

One of their major concerns is that they should be able to keep pace with the latest developments in their field.

"There will always be the fear that something you have designed will be out-of-date as soon as you have finished it," he says.

They also think that the present generation of computer technologists will find increased pressure from today's schoolchildren. Altwasser says that teenagers are now able to grasp ideas with which he had difficulty less than three years ago.

He adds that at the Earls Court Computer Fair he saw some children with leaflets about the Spectrum. As a joke he decided to ask them about it and was told enthusiastically about its capabilities.

New ZX81 Software from Sinclair.



A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.
Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.
Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.
Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.
Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.
Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.
Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)
Hardware required – ZX81.
Price: – £4.95.
Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.
Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Star Trail (plus blank tape on side 2).
Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – What are Biorhythms? Your Biohythms.
Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Programs – Backgammon. Dice.
Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Chess, Chess Clock.
Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantasy Games (Psion)
Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

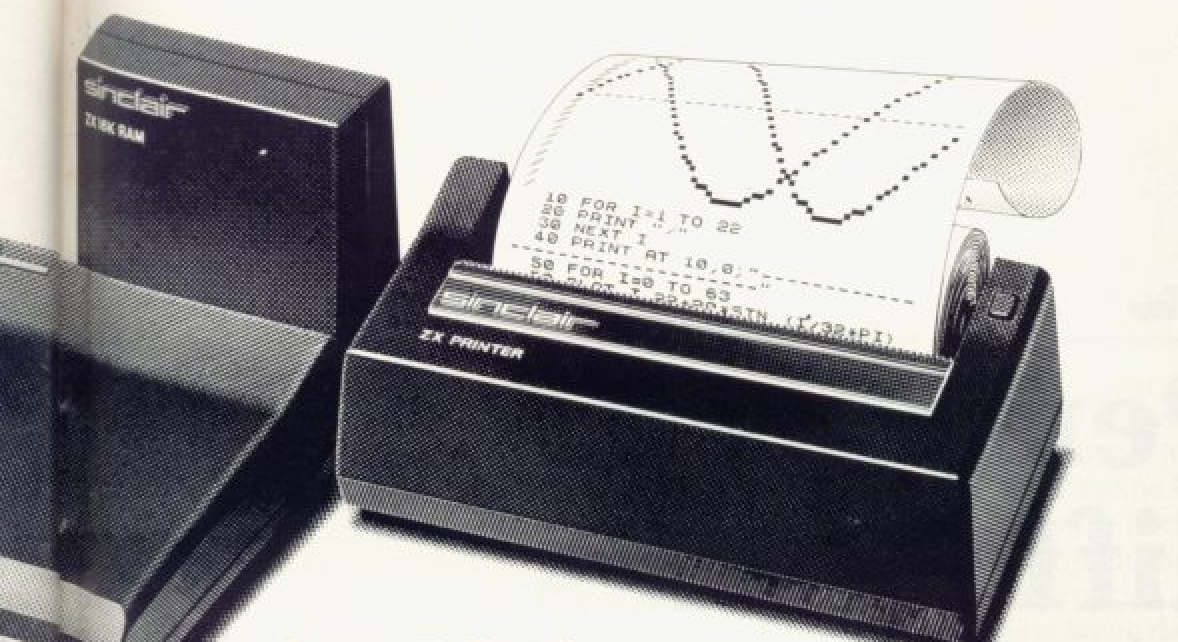
Cassette G13: Space Raiders and Bomber (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £3.95.
Programs – Space Raiders. Bomber.
Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Program – Flight Simulation (plus blank tape on side 2).
Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Novelists. Authors.
Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Poets, Playwrights. Modern Authors.
Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Towns in England and Wales. Countries and Capitals of Europe.
Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
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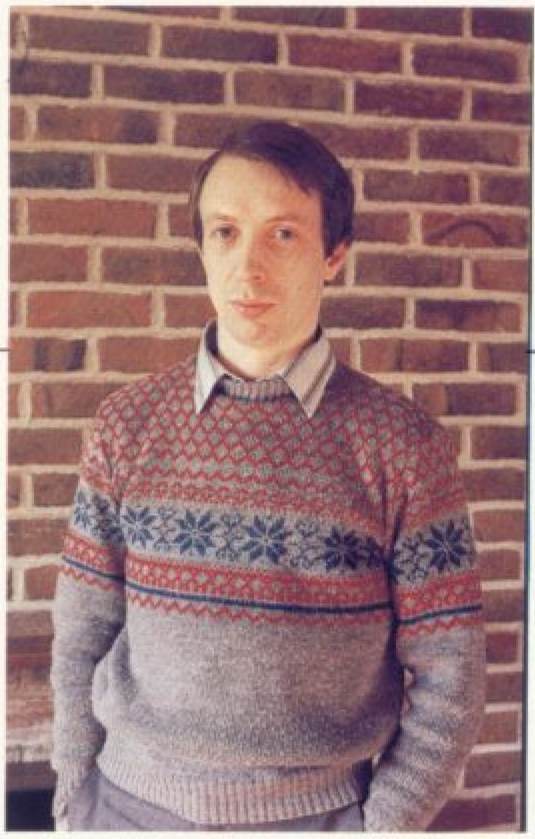
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Andrew Hewson



Peripheral difficulties

Andrew Hewson answers more of your problems, including some worries about the Spectrum and possible add-ons

I RETURN to the knotty problem of transferring data between programs but first I have some questions concerning peripherals. Peter Mann of Bedfordshire writes:

I have been told that if I use my existing hi-fi cassette deck on the new Spectrum, the computer would blow up. Why should that be so? I would much rather use my expensive deck than have to try a 'cheap' portable tape recorder.

The Spectrum is a low-voltage device designed to detect and decode the kind of poorly-reproduced, low-voltage signal levels obtainable from the earpiece of a 'cheap' portable tape recorder. In contrast, a hi-fi system is designed to deliver an accurately-reproduced signal with sufficient power to fill a room with sound. Large voltage fluctuations are normal from a hi-fi system, even at low volume levels, and so connecting a Spectrum to a hi-fi system clearly risks over-loading the computer.

To make the most of a Spectrum, you need it on a large table or desk, with TV, cassette player, books, magazines, pencil and paper to hand. I can understand that you do not wish to spend money necessarily on a portable cassette player but I am sure you would find it much more convenient to use.

Recently I have bought a ZX-81 for business use and am thinking of buying a ZX printer. Is the printer suitable for printing ready-gummed labels? asks John Modha, of Greenford, Midlesex.

Unfortunately, the answer is no. The ZX printer is capable only of printing on the special aluminium-coated paper supplied with it. I suggest you look at advertisements, as one or two firms supply a printer interface which allows the ZX-81 to drive a conventional printer.

Alan Pitcher of Jersey says: **I have just ordered a Spectrum. Can you suggest a cassette unit to use with it?**

Sinclair has improved the cassette facilities markedly in the design of the Spectrum and so it is hoped that we will all find it much easier to use than the ZX-80 and ZX-81 in that respect. Instead of recommending a cassette player which might not be available in your area, I suggest that you choose a shop which sells a variety of players and take your computer, your TV and a typical cassette and make sure you can LOAD and SAVE before you buy. I have done that and found that shopkeepers are happy to help, provided you ask permission and explain the problem.

My advice to Peter Stokes of Great Missenden is similar. He writes: **I would like to replace the TV I use with my ZX-81 by a small monitor to obtain better video resolution. Can you advise me?**

I would not bother to use a video monitor. I have seen various TVs and monitors connected to ZX-81s and with some the picture is poor and with others very good. It does not seem to matter whether you use a video monitor or not.

My preference is for one of the Ferguson range of small black-and white portables, which I find give a very clear picture and which cope well with the interruptions in the signal caused by the FAST command.

I shall probably be besieged by letters advocating another make or model and so I repeat the advice to 'try before you buy'.



Geoffrey Ottley is going to the States for three years and he asks: **Will I be able to use my computer in the U.S. without further adaptation or will I need a new transformer?**

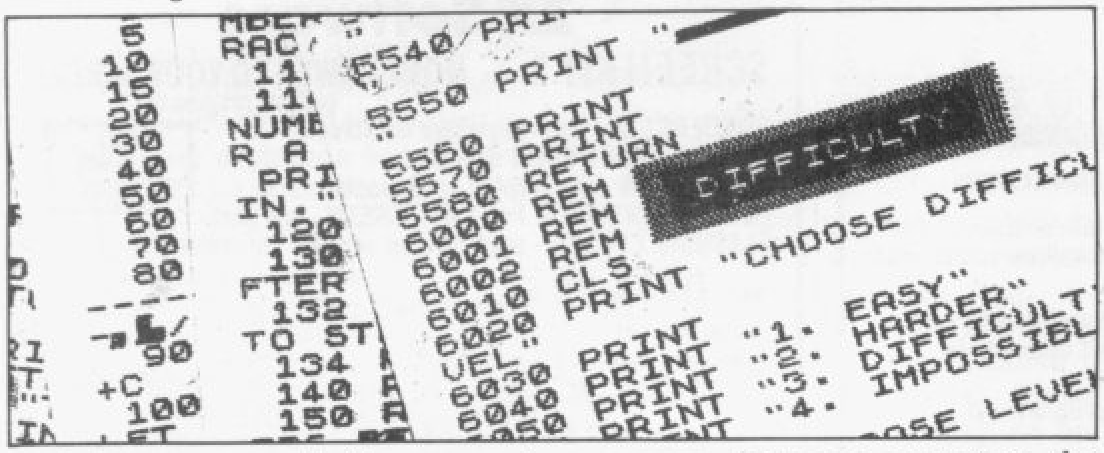
Electricity is supplied in the U.K. at 240V, 50 cycles per second, whereas in the U.S. the supply is at



120V, 60 cycles per second. Hence a U.S. power supply will be needed with an output of 9V DC and rated at 1.2 amps. It will also be necessary to use a TV made for the British market because U.K. TVs display 50 frames per second, whereas U.S. TVs display 60 frames per second.

The U.S. version of the ZX-81 is also rather better screened than the U.K. version, so if your new neighbours complain of interference on their TV you will have to put your computer in an earthed metal box. Perhaps it would be easier to buy a new ZX-81 on your arrival.

Now I return to a topic which has aroused a good deal of interest since I mentioned it two months ago. Readers of the first issue of *Sinclair User* will remember that I described two Basic routines for transferring data from a program, above RAMTOP, loading a second program from cassette and then transferring the data back to the variables area of the second program, thus enabling two programs to 'speak' to one another.



Les Auckland writes: **I would like to know how to SAVE and LOAD data only into a program held in core. Can you assist?**

There are two methods. The first is quick and elegant and consists essentially of writing new SAVE and LOAD routines in machine code. The second method is slow and clumsy but it is easy to understand and the necessary software is mostly in Basic, so I will explain it as the preferential method. The steps in outline are:

SAVE the data of interest on tape; to prevent the program in the ZX-81 being over-written, copy the program area above RAMTOP; LOAD the data from tape in the usual way; create some space in the program area and copy the program from above RAMTOP into the newly-created space in the program area.

Obviously, to create some data to LOAD into a program we must RUN a previous program to read in or calculate the data to be SAVE. The earlier program could be deleted line by line but the process is rather laborious, so use this technique instead:

First note the line number of the first line of the program. Suppose it is line number 10; then find the effective length of the program by entering PRINT PEEK 16396 + 256* PEEK 16397 — 16513.

Suppose the result is 1859. Then enter POKE 16511, 1859 — 256* INT (1859/256); POKE 161512, INT (1959/256); 10 or whatever was the first line number.

Do not attempt to LIST the program between entering the instructions or you will have to pull out the plug and start again. You are making the ZX-81 think that the whole program is one monster Basic line and if it attempts to LIST it all, it becomes confused. Entering 10, or whatever, deletes the monster line in the usual way.

The data can then be SAVEd, together with the display file and other odds and ends, on tape.

The second step is to LOAD a new program and store it above RAMTOP. The technique is very similar to storing data above RAMTOP which I have explained previously. Be sure to move RAMTOP down as explained on page 168 of ZX-81 Basic Programming before LOADing the new program. The following routine copies a program above RAMTOP:

```
10 LET J = PEEK 16396 + 256*PEEK
16397 — 17509
20 PRINT J
30 LET K = PEEK 16388 + 256*PEEK
16389
40 FOR I = 0 to J — 1
50 POKE K + I, PEEK (16509 + I)
60 NEXT I
```

The routine PRINTs the length of the program, J, in bytes. You should make a note of it because it will be needed later.

The data can then be LOADed from tape in the usual way. The current program will, of course, be over-written and so the final step is to copy it back from above RAMTOP. A machine code routine is needed for that step, because space must be created in the program area in which to store the program using a routine in ROM.

The routine is 20 bytes long and I suggest you store it at addresses 32748 to 32767 by entering and RUNning the following routine:

```
10 for I = 32748 to 32767
20 INPUT M
30 POKE I, M
40 PRINT I, PEEK I
50 NEXT I
```

Enter the following numbers one by one from the keyboard: 42, 12, 64, 229, 43, 1, 0, 0, 197, 205, 158, 9, 193, 209, 42, 4, 64, 237, 176, 201. You might like to determine how the routine works by translating the decimal numbers into Z-80 assembler using Appendix A of the ZX-81 Basic Programming manual.

Before running the machine code routine, POKE the program length, J, into it by entering

POKE 32754, J — 256*INT (J/256)
POKE 32755, INT (J/256)

Then delete the Basic routine, put the ZX-81 into FAST mode, and call the machine code routine by entering

IF USE 32748 = 0 THEN STOP.

● *Please address problems and queries to Andrew Hewson, Helpline, Graham Close, Blewbury, Oxfordshire.*

Philip Joy considers a game of chess written for the 1K ZX-81 and finds it is very restricted

Simple chess limits moves



TO DISPEL some confusion **about Noughts and Crosses,** I have received a letter indicating that I made two statements which contradict each other.

"If you have ever played a computer version of the game, it tends to be very easy to beat", was the first comment.

That statement refers to a version of the game which contains no skill at all — just the rules to play the game. As you would agree, an uninteresting game with little skill demanded. The second statement is:

"Gives you a chance to win now and then, unlike many Noughts and Crosses which are which are unbeatable . . ."



That one refers to what happens if you insert a large amount of skill — it becomes unbeatable and boring. If, however, you have the computer learn by your mistakes, as the article was suggesting, it will become more difficult as you play. That will give players a chance to win, providing that the player always plays to his normal standard.

I was also sent a 1K chess program in a neat package, with a cassette inlay created on the ZX-81 printer, with the instructions on it. The author is D Horne, Cowbridge, East Sussex. I have asked for some comments from two other people on the game and I thank Ian Benyon and Leo Amatino for their help.

There are some restrictions on what the game can do, because it had to be fitted into 1K. Those restrictions are no castling, no en-passant, and no pawn promote. The comment on those restrictions was that it spoiled the game. I shall stick out my neck and say what I have always said — that the unexpanded ZX-81 cannot do anything constructive, except be used to control something.

I must also say that after I have seen the game, my mind is not changed. The game is satisfactory for 1K but is nothing like what can be achieved on the ZX-81.

Amatino says he thinks it plays the same game, and both he and Benyon say that it was a very short game. Horne says it is the ultimate for the 1K ZX-81; I suppose that is true.

It is neatly packaged and costs £5. Amatino said that it was not worth the money. I would say that if you have a 1K ZX-81, you could have some enjoyment from this inexpensive game.

A Leicester reader sends details on the Artic Computing ZXchess II. He includes a game which I shall try to include in a future issue. His comments are rather interesting, as they support my point about the end game. He says:

"The end game is less positive". He says of the save facility of the game: "The most significant advantage of this particular program is the save facility".

A Cumbrian reader has sent a game played against Sargon 2.5 and ZXchess II. ZXchess won. He says that one bad move by Sargon clinched it. That is interesting, because I have a version of Sargon on my Video Genie computer and I have found it be be of reasonable standard.

I shall include some of the many games which have been sent to me when I have played them and can comment on them. One reader has sent a letter saying that he did not know chess games were implemented on such small computers; he must be surprised.

I hope you can send me details of anything to do with chess or mind games in general. Some comments on adventure games would be most helpful, as that is my interest, and I would like to know how other people feel about them.

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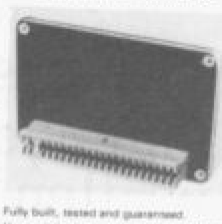
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Alter your next PRINT position in the direction indicated

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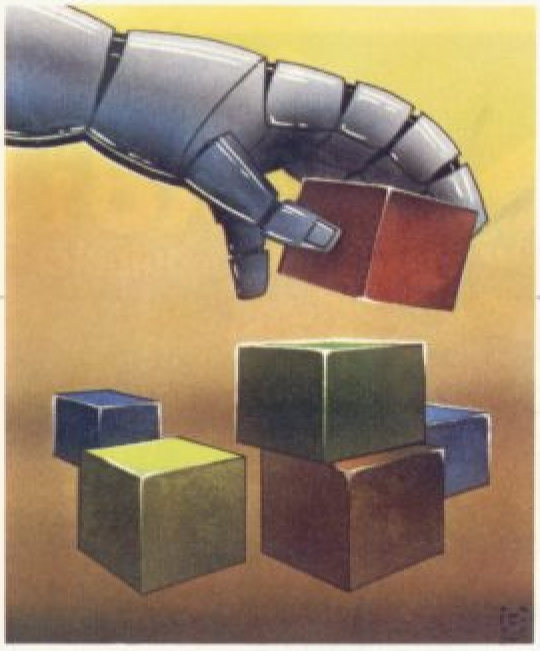
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Playing games with machine code

In the last of his three articles Mike Biddell looks at ways of using machine code in game simulation

IN THIS FINAL article we examine how our simple machine code routine scroll down can be used to good effect, to produce a game simulation. We will examine how a supporting program written in Basic can call the USR routine to maximum effect and how the whole program can be built and tested stage by stage. A logical procedure to adopt at this stage is:

Decide the game appearance, strategy and rules. This must be considered in the context of scroll down, since we intend to use the routine we have developed.

Produce a series of statements concerning the program flow and operation. For a program as small as this, a full-blown boxed chart is considered unnecessary by the author.

Using the statements, build-up the program piece by piece, testing as you proceed for the desired effect.

Soak test the entire program for several hours, by letting your friends, acquaintances and children loose on it. If there are any undiscovered bugs they will find them.

I have always had in the back of my mind the thought that scroll down would produce an excellent moving roadway or airfield effect, so we will build the game around that idea. If you have other ideas for applications of the routine, feel free to pursue them. Here is my concept of the game plot.

It is war-time and you are flying a transporter aircraft to land supplies behind enemy lines. As the runway approaches, you can see that it is mined but it is too late at that stage to pull up, since your airspeed is too low. You have, therefore, to land and taxi around the mines to take off again and see the runway recede.

If you hit a mine or go off the side of the runway, the aircraft crashes. It sounds exciting, so let us proceed to the statement portion of our development plan and produce a series of statements about how the program might flow and operate.

Main program loop, using PRINT AT function to produce the runway element. Call USR to scroll that element downwards. Put the USR call in a loop and that should produce a moving runway effect.

Add the aircraft path by adding a POKE statement into the loop. Allow the aircraft to be steered left and right by using inkey $ to modify the POKE address. Scroll down should create a plot of the previous positions of the aircraft.

Within the loop, POKE the mines on to the runway, in varying positions. Add the logic for a mine or verge collision. That should send the program pointer outside the loop for a comment and game re-start.

Add program to advance the taxing speed of the aircraft as it proceeds. Finally, incorporate program lines to signify a win; create a receding runway and a jump outside this loop to comment on the win and allow game re-start.

Figure 1: MAIN PROGRAM LOOP

```
   1 REM E£RND)?"; FAST "57( CLE
AR FAST SGN LPRINT :<"5$4 PRINT
TAN MMMMMMMMMMMMMMMMMMMMMMMMMMM
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MM
   3 LET T=16514
   7 PRINT AT 20,9;"**RUNWAY**"
  10 PRINT AT 1,10;"▀      .      ▀"
  20 LET A=USR T
  50 GOTO 10
```

Figure 2: VDU PICTURE CREATED BY MAIN PROGRAM LOOP



Now let us make a start with the main program loop. Delete lines 10, 20, 30 and 40 of the scroll down test program and add lines 7, 10, 20 and 50 as shown in figure one. Line 7 prints the game title on line 20 of the screen; that is not scrolled, since our routine scrolls only 19 lines. Lines 10, 20 and 50 produce the approaching runway effect — study this three-line loop carefully.

Then run the program and you should see, if all is well, the runway approach. Press BREAK before the runway reaches the bottom of the screen and you will have a VDU picture similar to that shown in figure two. Our main program loop incorporating the machine code works.

Now add the aircraft path and some means of steering it. I have



chosen an asterisk (*CHRS(23)) to represent the position of the craft at any time. Since we will be POKEing the asterisk into the display file we will have to locate it, as described previously, by PEEKing system variables 16396 and 16397 and using those to define a variable W.

Then add the following lines to the developing program:

4 LET V = 411
5 LET W = PEEK 16396 + 256* PEEK 16397
30 LET V = V + (INKEY $ = "8")— (INKEY S = "5")
40 POKE W + V, 23

Variable W in line 5 defines the start address of the display file and variable V in line 4 is the displacement to be added, to position the asterisk in the correct place on the screen.

The POKE statement in 40 places the asterisk on the screen, directly below the runway. The value of V was determined by trial and error.

The steering logic is in line 30. It uses inkey $ to decode keys 5 and 8 on the keyboard — the keys with the left and right arrows. That works on the basis that if inkey $ = "8", then the whole expression inkey $ = "8" is given the value 1 (true). That applies to inkey $ = "5" in the same way. Thus, if inkey $ = "8", that adds 1 to variable V and moves the screen POKE one position to the right; if inkey $ = "5" it is moved to the left.

Then run the program with these additions and you can steer the aircraft from left to right. With its controlling logic, you can steer it anywhere you like, including off the runway.

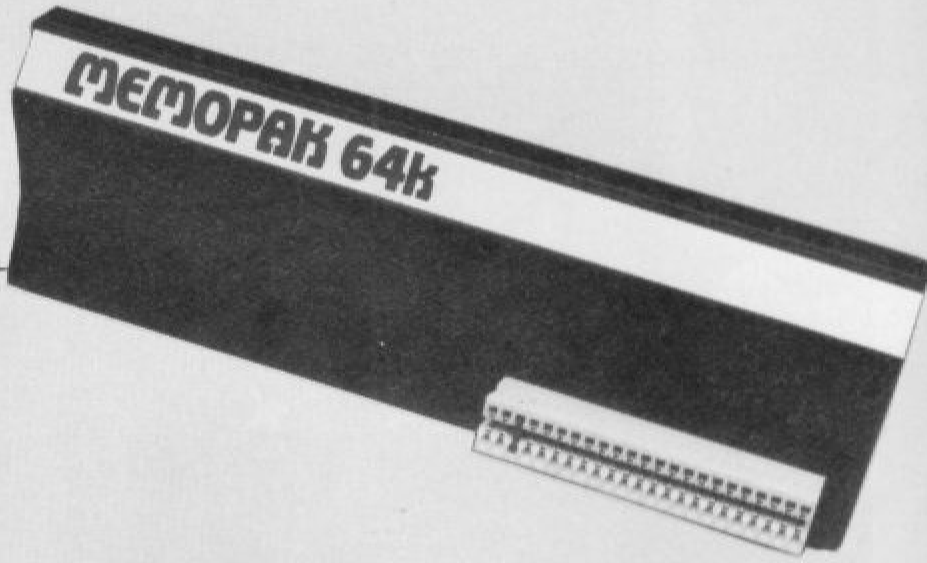
We have covered items one and two of the main program specification and I have been doing all the work. It would be excellent practice for you to add your own program lines and complete the program; test them carefully as you proceed.

For those who feel less inclined to tackle the task, a completed program — it is only one solution — is presented in figure three. Compare the additional lines to the rough program specification and you will begin to understand how it operates. To be frank, I have not yet managed to get the aircraft back off the runway. Is it possible? Perhaps with more practice I might make a better pilot.

In conclusion, if you have followed the articles, you have a mini-machine code loader and an understanding of how to write simple machine code and incorporate them in a Basic program. It is not too soon to be thinking about your next machine code challenge.

Figure 3: "RUNWAY" — COMPLETE PROGRAM LISTING (Basic and Machine Code)

```
   1 REM E£RND)?"; FAST "57( CLE
AR FAST SGN LPRINT :<"5$4 PRINT
TAN MMMMMMMMMMMMMMMMMMMMMMMMMMMM
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MM
   2 LET S=0
   3 LET T=16514
   4 LET V=411
   5 LET W=PEEK 16396+256*PEEK 1
6397
   6 CLS
   7 PRINT AT 20,9;"**RUNWAY**"
  10 PRINT AT 1,10;"      .     "
  20 LET A=USR T
  21 LET R=INT (S/10)
  22 IF S-R*10=9 OR S-R*10=6 OR
S-R*10=4 THEN POKE W+V-33*INT (V
/33)+99,52
  30 LET V=V+(INKEY$="8")-(INKEY
$="5")
  35 IF PEEK (W+V)=3 OR PEEK (W+
V)=52 THEN GOTO 100
  40 POKE W+V,23
  41 IF S=100 THEN LET V=V-66
  42 IF S=150 THEN LET V=V-33
  43 IF S=200 THEN LET V=V-99
  44 IF S=250 THEN GOTO 250
  45 LET S=S+1
  50 GOTO 10
 100 POKE W+V,61
 110 PRINT AT 21,0;"TOO BAD YOUR
E DEAD REPLAY Y/N?"
 120 INPUT Y$
 130 IF Y$="Y" THEN RUN
 140 GOTO 120
 250 PRINT AT 1,10;"           "
 260 LET V=V+(INKEY$="8")-(INKEY
$="5")
 270 IF PEEK (W+V)=3 OR PEEK (W+
V)=52 THEN GOTO 100
 280 POKE W+V,23
 290 LET S=S+1
 300 IF S=270 THEN GOTO 400
 310 LET A=USR (T)
 320 GOTO 250
 400 PRINT AT 21,0;"WELL DONE RE
PLAY Y/N?"
 410 INPUT X$
 420 IF X$="Y" THEN RUN
 430 GOTO 410
```



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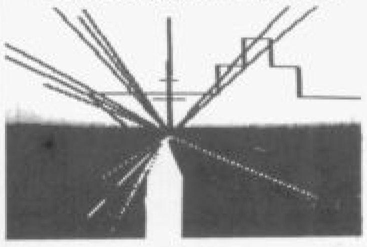
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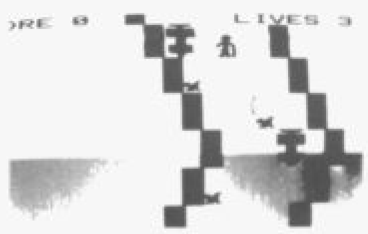
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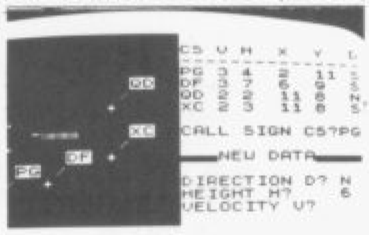
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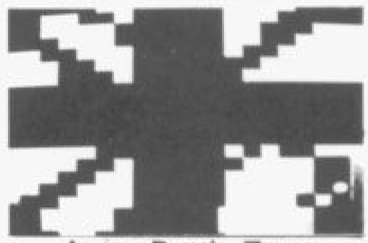
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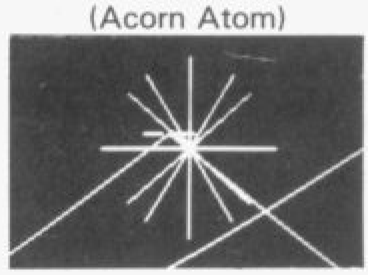
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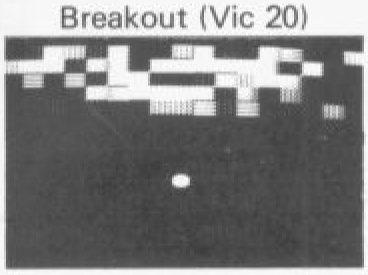
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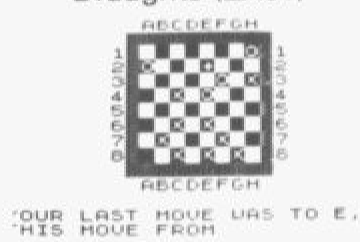
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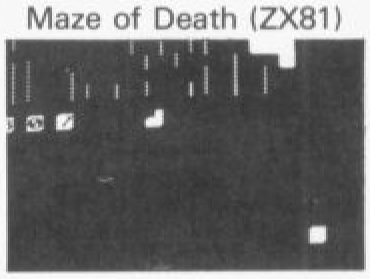
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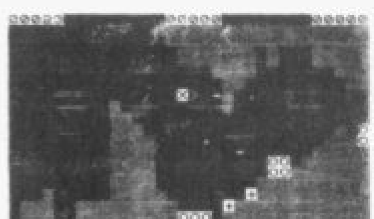
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